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THE NATURAL RESOURCES CONFERENCE.

For the first time in the history of our country the governors of the States have been invited into conference by the President, and the meeting took place at the White House last week, when over 40 governors participated in the discussion of the best means to conserve and preserve the natural resources of America. The occasion was obviously one of first-class historic importance, and while the body thus composed of governors and of experts, publicists, engineers and journalists invited to assist, had no executive or legislative powers, the mere fact that such a gathering has taken place, and has given its approval to the President's "counsel of warning" on this momentous topic, will be productive of lasting good. The governors, now that the example has been set, will probably get together again, either in the White House or outside; but whether they do or do not, the duty of scientific, engineering treatment of our great stores of natural wealth has been brought to the attention of the whole people in a manner that can only promote the national welfare. Several of the governors have gone home to investigate reform and regulation; and every instance of that kind will relieve the central, Federal authorities of some burdens and ensure for the public benefits whose value can hardly be calculated through the long future of national existence.

GROUNDING OF SECONDARIES.

The Committee of the National Electric Light Association on the Grounding of Secondaries does not, in its report submitted at the Chicago convention, confine its recommendations to the grounding of alternating-current circuits, but proposes also a rule for direct-current circuits. In each case grounding is made mandatory up to a voltage of 150, but coupled with the astonishing prohibition that a circuit must *not* be grounded when the difference of potential between the ground and any part of the circuit would exceed 150 volts. No reason is given for this limitation of voltage; and as the principal object in grounding the secondary or alternating-current circuits is the protection of life, under such a rule protection will be withheld at voltages introducing the higher life hazard. It is true that the number of installations coming under the prohibition against grounding is likely to be very small, but in a matter affecting life it would be better to prohibit entirely such classes of installations than withhold protection from those endangered by them. The report admits that at a conference on the subject with representatives of other bodies, this limitation of protection to 150 volts did not meet with the approval of a committee of the American Institute of Electrical Engineers, which committee, by majority of one, voted in favor of a limited voltage of 250. The latter figure would probably cover every case of secondary circuit installed where protection is most needed, and it would be interesting to know why the recommendation

of the A. I. E. E. committee was rejected. In fact, the report is anomalous in presenting no reasons or arguments supporting its recommendations, if we except statements that over 99 per cent of lighting circuits are ordinarily run at 150 volts or less. Until satisfactory reasons for limitation of protection to 150 volts are presented, the report of the committee will lack weight with the underwriters who are asked to act upon the recommendations. The insurance interests look upon the matter of grounding the secondary as one relating to humanitarianism rather than to fire hazard, and they will not be apt to be impressed with an appeal for action on their part which ignores in part the humanitarian consideration.

Use of the Term "Light-Flux" in Illuminating Engineering.

As problems in artificial illumination become treated more and more along engineering and scientific lines rather than by cut-and-try methods, greater need is felt for accurate and convenient units for expressing light quantities and their physical relations. Perhaps the most familiar unit employed is that of light—that is, the candle, or its equivalent. Equal to it in importance in illuminating engineering, and next to it in familiarity, is the unit of illumination produced by a unit of light at unit distance from the source. The terms frequently employed interchangeably for this unit are "foot-candle" and "candle-foot." Of these two terms it would seem that the former is preferable, because the plural should be "foot-candles" and not "candle-feet." Doubtless the foot-candle as a unit of illumination will remain in use for many years, although, as pointed out by Dr. C. H. Sharp in his presidential address before the Illuminating Engineering Society, it is desirable to abandon this unit for the more appropriate and less confusing unit relating to light flux, namely, the "lumen." Quite independent of the value that may be assigned to the unit of light flux, and the name by which it may be designated, it is extremely instructive to keep constantly in mind the conception of the "light-flux" from a lamp, rather than its "candle-power," or "foot-candles" which it may produce at a certain distance. The lamp should be looked upon as the source of a certain number of light-rays which travel indefinitely in straight lines unless absorbed or reflected. A perfect reflector changes the direction of the rays, but neither increases nor decreases their number.

The above-described physical relations are so well known that it might seem unnecessary to call attention to their existence. However, the reports that are frequently received from photometric investigations, and the solutions that are offered for various problems in lighting with lamps equipped with reflectors, show that these well-known relations are often ignored. For example, when the so-called "polar candle-power curve" of a lamp equipped with a reflector is given, the fact that it is absolutely essential to state at what distance from the lighting unit the measurements were made, is rarely recognized. If a lamp with a reflector giving a true parallel beam of light is photometered at, say, a distance of 10 ft., and subsequently at 20 ft., its maximum "candle-power" on the polar curve in the latter case will be four times that in the former; the "light-flux density," however, is, of course, equal in the two cases. The conception of the total light flux from a lamp as its real output leads one at once to the conclusion that if a certain floor area is illuminated by a certain number of lamps equipped with the reflectors whereby all of the light rays strike upon the floor, the total light flux over the floor and the average light-flux density will be constant, independent of the height of the lighting units. Moreover, if the walls and ceiling of a room are of such nature that no light is absorbed, the average light-flux density over the floor area equals the total light flux from the lamps divided by the area of the floor, quite independent of the position of the lamps. The exact conditions here assumed are ideal and cannot be obtained in practice, but the relations illustrated by them are real and should not be ignored.

Longitude by Wireless.

One of the most interesting propositions for the practical utilization of wireless telegraphy is its use for determining longitude at sea. A French commission, headed by M. Poincaré, is now investigating the project which, on its face, looks practicable and valuable. As our readers well know, the finding of longitude is and always has been a very troublesome matter. Practically it amounts to finding at any point the local time and comparing it with standard meridian time carried by the ships' chronometers. In clear weather on land this is a very easy matter indeed, but at sea with no fixed instruments it is troublesome, and there are often long periods of thick weather during which no observations can be taken and one must depend upon dead reckoning. Even when good observations can be had, there is more or less uncertainty regarding the rates of the chronometers which cannot be checked during the sea voyage save by comparison with each other. The wireless project is directed to the distribution of standard time signals so that the chronometers can be checked during the whole of a trans-Atlantic voyage as readily as they would be by telegraphic signals or the dropping of a time ball while in port. The plan is to distribute time signals over the whole ocean by wireless from a central station located at some convenient point—the peak of Teneriffe, for example.

Carried out in this way, the chronometer error in the determination of longitude would be practically eliminated, thus considerably simplifying the situation. There still remains the difficulty of finding local time in thick weather. In clear weather, with the chronometer error out of the way, positions can be ascertained with very satisfactory precision. There is, however, another possibility of a somewhat startling character which may yet be realized. If it becomes possible to send out a wireless impulse that shall travel clear around the globe, finding longitude will be a very simple matter. For at the speed of electrical waves an impulse would girdle the globe equatorially in about a seventh of a second. A ship 180 deg. of longitude from the sending station would receive two impulses, one from each direction, simultaneously, and one-fourteenth of a second late. At any other place she would get the two impulses received on the same instrument at an interval which depends directly upon her position in longitude. It should be possible to measure this interval, say, by a revolving mirror method with sufficient precision to give a very good position in any weather. Assuming the wave path to be a great circle, a second sending station would enable a ship to get two angular co-ordinates from a known base which would fix her position both in longitude and latitude. Evidently the success of such a process depends on some factors as yet unknown. It is by no means certain that the wave path would

necessarily be a great circle or that the speed of propagation would be exactly uniform. If, however, variations from the uniform law were systematic they could be soon ascertained and allowed for. Of course, the interval of time to be measured is very small, but it is nevertheless capable of surprisingly exact measurement, good enough certainly to give a great improvement over dead reckoning. Such possibilities are a strong argument for international control of wireless since the success of such a revolution in navigation as is here outlined would depend upon an international agreement for silence in the ether while the world-wide signals were being distributed.

THE INDUCTANCE OF ELECTRIC TRANSMISSION LINES WITH UNSYMMETRICALLY DISPOSED CONDUCTORS.

The flux surrounding and linked with alternating-current transmission lines is rapidly becoming a vexed question, in view of the rapid growth of such lines and their increasing disturbing influences upon neighboring wires. But the troubles are not confined to neighboring wires and extraneous circuits. They also extend to the conductors of the same circuit. If the three conductors of a three-phase transmission system, for example, are symmetrically disposed, so that a vertical section of the line presents the wires at the vertices of an equilateral triangle, we know that the self-induced e.m.f. of reactance on these lines will not tend to unbalance the system; but that if the lines are dissymmetrically disposed, the self-induced voltages will, in general, tend to throw the voltages of the system out of balance. The analysis of the e.m.f's. induced in a multiphase transmission line is presented by Mr. Alfred Still in the article on page 1098. The total flux linked with each conductor may, as is pointed out, be considered as the sum, with reversed sign, of all the individual fluxes surrounding the return currents with respect thereto. From this proposition the various e.m.f's. of self-induction may be readily deducted, no matter what the relative geometrical arrangement of the conductors may be.

It is curious to observe that, according to the vector diagrams presented, a two-phase system with three wires, at equal distances apart, will develop a set of induced e.m.f's. which is obtained by rotating the balanced vector current system through a negative angle of 90 deg. On the other hand, when the wires are not equally spaced, the star of induced e.m.f's. is not obtained by a mere quadrature twist of the vector current diagram. There are also individual displacements of the e.m.f's. to be added. In either case, however, whether the three wires of a two-phase system are equally spaced or not, it would seem that the e.m.f's. of self-induction superposed upon a balanced two-phase voltage system will tend to unbalance it, so that it is not of great importance to keep the wires of such a system at equal distances apart. If, however, a four-wire two-phase system were adopted, this discrepancy would disappear. The effect of transpositions among the wires at intervals along the line is omitted, but may be easily taken into account.

PARALLEL OPERATION OF ALTERNATORS.

Following upon an editorial article on the subject of the parallel operation of alternators, in our issue of the 28th December last, we have published in our correspondence columns of Jan. 25 and Feb. 15 two communications elicited by that article, and bearing upon the interesting experimental fact that an alternator may be driven in parallel with others, even when its field excitation has been removed. It is hardly necessary to point out that with direct-current generators this could not occur. If, for example, a number of direct-current units are operating in parallel between central-station busbars and the field-excitation of one unit is removed by the opening of its field circuit, that unit will be deprived of its e.m.f., and it will virtually constitute a short-circuit on the system unless automatically removed by its circuit-breaker. With alternators, however, operating in parallel between busbars, if the excitation of one unit is suddenly removed, there will be a relatively large wattless component of current supplied to the machine from the busbars, but the unit may not fall out of synchronism. and may even supply a considerable amount of power to the system. The communications referred to supplied experimental evidence of this fact, under particular conditions of operation. Indeed, the phenomenon may be carried yet further in the case of a synchronous motor running on light load. As pointed out by Dr. Steinmetz at Niagara Falls last year, if such a motor be running in synchronism, not only may it run without excitation, but if the excitation be reversed, the machine may still run in synchronism, taking a powerful wattless current, until at a certain value of the reversed excitation, the machine will slip a pole and run in normal synchronism with normal armature current and with the excitation no longer in opposition.

The article of Mr. Henry Herman, on page 1100 of this week's issue, takes up the analysis of the action in a synchronous unexcited machine, and throws light upon the development of torque in these cases. According to the simple theory of alternator operation, assuming constant synchronous impedance, it is easily shown that on light load a relatively small proportion of the normal e.m.f. generated in the armature may serve to keep a motor in synchronous operation. This elementary theory, although satisfactorily explaining ordinary conditions of load, breaks down completely when the e.m.f. is practically reduced to zero by withdrawing the field excitation. Some modification in the theory is necessary to explain the maintenance of torque in the unexcited motor. Mr. Herman's article points out that the effect may be explained by taking into account the cyclic variation of the armature reactance at different successive positions with respect to the field-poles. The article shows that the inductance of the armature not only consists of the flux per ampere linked with the armature conductors and confined to the armature grooves, but also includes the flux, per ampere, linked with the field pole-pieces and also with the field coils. These extraneous linkages vary as the coils occupy successively varying positions with respect to the field-poles. Expressing the reasoning of the article in a condensed alternative form, the average electromagnetic energy owing to inductance during one current cycle is markedly greater, for a given armature current strength, if the armature is running in synchronism than if it breaks out of synchronism. Consequently, the machine will exert a torque of self-induction tending to maintain synchronism, and this condition will apply whether the machine be operating as a generator or as a motor. If the inductance of the armature were exactly the same in all positions with respect to the poles, this increase of magnetic energy in synchronous relation would disappear, and the corresponding torque tending to maintain synchronous relation would disappear likewise. Apart from the questions of theoretical explanation discussed in the article, the property of tending to maintain synchronism in the absence of excitation indicates the remarkable flexibility of the synchronous alternator.

National Electric Light Convention.

(By Telegraph.)

The thirty-first convention of the National Electric Light Association began on Tuesday at the Auditorium Hotel, Chicago, the city that witnessed the birth of the association more than a score of years ago. From the outset a large attendance was indicated, the anticipatory registration being over 1100, so that a final attendance of at least 1500 is expected. Owing to the transportation plans made, the attendance prior to the opening of the convention was very much larger than usual. The special train over the Pennsylvania Railroad, conducted by Mr. George F. Porter, master of transportation, carried no fewer than 108 people, and made a smooth run on Sunday, arriving in Chicago before 9 o'clock Monday morning. Other large parties came in from the East and West. Among those present are several past presidents, including Messrs. Insull, Doherty, Blood, Ferguson, Davis, Ayer, Huntley, Edgar and Williams.

The opening of the convention is associated with cool but stormy weather, but better conditions are promised for the excursions and entertainments that are laid out for practically every day of the week. Great interest is taken in the visit to the Fisk Street plant of the Commonwealth Edison Company, and the full description in last week's issue of the ELECTRICAL WORLD is highly praised. The plan put in effect this year of having the erection of exhibit booths and the delivery of goods in the hands of an exhibition committee, which contracted for the work and handled it in a systematic way, worked with remarkable smoothness and saved exhibitors much worry. As a result exhibits were in place in due time for the formal opening of the exhibit hall on the ninth floor of the Auditorium Annex at 8 o'clock Monday evening. At that hour President Farrand threw in the main switch controlling the general lighting of the hall, and the first exhibit of the association to be lighted entirely by tungsten lamps was formally opened, thus marking an important milepost in the American central-station industry. After an hour spent in the exhibit room as guests of the exhibitors, the delegates adjourned to a formal reception in the Annex, to be followed by dancing.

The first session opened Tuesday morning at 11:40. President Farrand's address referred to the increasing importance of the association for good or ill. Active members now number 664 in class A, 394 in Class B and 151 in Class D. The increase in the year is 10 per cent. The old question box, he stated, was inefficient and slow. The monthly bulletin of the association was started last August with eight pages to answer questions and for other matter. It has since grown to 16 or more pages and costs less than the old yearly question box, and is more satisfactory. The officers and committees have held weekly meetings during the past year at the association's headquarters. Questions of public policy are now attracting more attention than ever before. The recent agitation for a multiplicity of commissions, national, State and municipal, for regulation purposes, is likely to interfere seriously with the conduct of central-station business. He pointed out the injustice of the low-maximum rate. The New York commission had prevented several companies from making improvements, but accomplished no real good during the past year. As to municipal ownership the pendulum has already swung to its farthest extreme and now sentiment is waning. He said that the program had been drawn up with few subjects to permit much discussion. One parallel or branch session was arranged for, although he does not believe in subdivision of association work. He acknowledged the efficient work of Secretary Freeman, Miss Billings and the office staff during the past year.

The address was followed by Mr. Martin's report on progress and Luke's paper, the latter being dicussed at length by Osgood, Steinmetz, Junkersfeld, Gear and others. (Abstracts of convention papers will be found elsewhere in this issue.)

Conservation of Natural Resources.

Creating a new precedent, taking a step that for some unexplained reason has never been taken before, President Roosevelt last week called a conference of governors of the several States of the Union to discuss the conservation of the national resources of the country and to take such action as might appear proper to prevent further waste and extravagance. In inviting the governors, Mr. Roosevelt suggested that each be accompanied by three officials and citizens of the respective commonwealths interested directly in the subject. In response to this novel summons, the first of the kind in the history of the country, no fewer than 41 governors attended the conference. To meet them and assist in the deliberations, the President invited also the heads of all the great national bodies representative of trade, agriculture, engineering and finance. The American Institute of Electrical Engineers was represented by President Stott, accompanied by Secretary Pope. The National Electric Light Association was represented by President Farrand. There were four representatives of the American technical press, Messrs. Kirchhoff, of the *Iron Age;* Baker, of the *Engineering News;* Ingalls of the *Mining and Engineering Journal,* and Martin, of the ELECTRICAL WORLD.

The conference was held at the White House, in the famous East Room, where no such meeting had ever gathered before, and each session, from Wednesday until Friday, was opened by President Roosevelt, who then called a governor to the chair for each session except the last on Friday, of which he remained the chairman throughout. Every session was attended by members of the cabinet, all of whom spoke, and members of the U. S. Supreme Court, the Senate and House of Representatives were also in attendance from time to time, as well as heads of the various bureaus of the government. Mr. T. R. Shipp was secretary of the conference, and Dr. W. J. McGee, of the Inland Waterways Commission, organized the arrangements and the conduct of the convention as a whole.

On Wednesday, May 13, President Roosevelt opened the conference with a striking address on "Conservation as a National Duty," in which he took occasion to emphasize his policy as to the control of water powers, the limitation of franchises for their use, and the exaction of a charge based on the extent of their development. After this address the conference adjourned and the sessions for the three days were then divided into the treatment of mineral resources, land resources and water resources. At the session on Wednesday afternoon Mr. Andrew Carnegie read a most interesting paper on ores and related minerals, and showed how rapidly the supply of ore and coal was being exhausted. This was followed by a paper on fuel exhaustion by Dr. I. C. White, State Geologist of West Virginia. One of the speakers in the discussion was Mr. John Mitchell, the well-known leader of union coal miners, who made an admirable speech in advocacy of the conservation of human life.

In the evening a dinner was given to the governors by the Washington Board of Trade, at the New Willard Hotel, this affair being presided over by Gen. George H. Harries, who is a member of the executive committee of the National Electric Light Association. Among the speakers were Vice-President Fairbanks, Speaker Cannon and the Hon. John Sharp Williams, leader of the Democratic minority in the House.

The morning session of May 14 was opened by a weighty address from Mr. James J. Hill, the great railroad manager, on the "Natural Wealth of the Land," in which he adduced

statistics that showed how under prevalent methods, the fertility of the American soil was slowly but surely declining. It made a profound impression. Other papers followed on soil wastage and forest conservation. Secretary of State Root took part in the discussion, laying great stress on the duty of the States. The afternoon session resumed the treatment of this topic, with a paper from ex-Governor Pardee, of California, on land resources as related to irrigation. In the course of this paper he expressed fear as to a "monopolization" of the water powers of California, and said: "The action of the United States government, however, in regulating the use of these streams ought to prevent an absolute and oppressive monopolization of them." This remark was heartily approved by the conference.

The closing session on Friday morning, May 15, was conducted throughout by President Roosevelt in person, and constituted in many ways a dramatic finale of a most significant conference, setting in motion forces and agencies that will operate through long ages. The governors, to a committee of whom a great variety of resolutions had been referred, adopted at the opening of the session a "declaration of principles," dealing with the topics raised and in one paragraph expressing a "strong conviction" as to the duty laid upon the States "to conserve the navigation and other uses of our streams, and the minerals which form the basis of our industrial life and supply us with heat, light and power." These declarations, looking with favor upon further conferences of the same kind, were adopted unanimously after a little brisk discussion as to the commitment involved by each State.

Mr. W. J. Bryan, the leading Democratic candidate for the presidency, was then introduced by Mr. Roosevelt, and made an excellent address summarizing the results of the conference and insisting that there must be "no twilight zone between the Nation and the States, where predatory exploiting interests could take shelter from both." A little later President Roosevelt referred to the "twilight land" and said that the one aim in developing his policy had been to find and provide some sovereignty, whether in the Nation or the State was indifferent, that could control and hold accountable the great corporations and the big individuals, too. With regard to water power rights, he believed strongly that no perpetual franchises, but renewable ones, should be granted, and that for these compensation should be paid. This would guarantee to future generations the right to control natural resources upon which they must depend, and to terminate such franchises if proper. "Where this policy can be carried out best by the State it ought to be by the State. Where it can be best carried out by the Nation, then the Nation should enforce it. My concern is not in the academic discussion of either the principle of State rights or the principle of National sovereignty, but what will best conserve the needs of the people as a whole." Aside from this he was willing and desirous that any corporation developing natural power resources should derive a handsome return for its initiative and enterprise. This outspoken declaration elicited applause that lasted several minutes.

During the morning, addresses were made by a number of governors on the subjects under discussion, and at the close steps were taken, by the governors in executive session, to provide for a repetition of this meeting, although not necessarily at the White House. It had been found by all the governors a most useful and desirable thing to consult together, and the wonder was generally expressed that in the 120 years of national life such a conference had not been held before.

Among the three papers presented at the final session on Friday was one by Mr. H. S. Clair Putnam, member of the American Institute of Electrical Engineers, on the "Conservation of Power Resources." This admirable paper brought out very clearly the enormous growth in recent years of electrical development, particularly as typified in manufactures, and said: "Prior to 1870 the use of water power in manufactures exceeded that of steam power. Water power expressed in percentage of the total power employed has since steadily declined, falling from 48.3 per cent in 1870 to 11.2 per cent in 1905. During the corresponding period steam power increased from 51.8 per cent in 1870 to 78.2 per cent in 1900. The census of 1900 showed a marked falling off in the rate of increase in the percentage of steam power used as compared with the rate prior to 1890, and this was accentuated in the census of 1905, when the percentage of steam power fell to 73.6 per cent of the total. This check to the ascendency of directly applied steam power was due to the introduction of electric power. In 1890 electric power was negligible. In 1900 it constituted 4.8 per cent of the total. In 1905 this had increased to 11.8 per cent—a marvelously rapid growth when the aggregate increase of over 1,000,000 hp in five years is considered. If the present rate of increase prevails until 1910 electric power will have reached 18 per cent of the total and steam power will have dropped to 68 per cent. If the same rate of increase is maintained until 1930, electric power as applied to the manufacturing industries will exceed the amount of steam power applied direct."

Mr. Putnam insisted very strongly on the necessity of governmental regulation of the water powers upon which such extraordinary results were predicated, and he urged the great necessity of a trustworthy census of the water powers of the country.

New York Companies to Supply Tungsten Lamps.

The hearing before the Public Service Commission on May 14 in the matter of the investigation of the New York electric companies was largely devoted to a discussion of the latest step of the companies in putting the tungsten lamp within reach of the consumers. Mr. J. W. Lieb, of the Edison Company, told of his company's plans to reduce the price of tantalum lamps, as reported in these columns in the issue of May 16. The price for the tantalum lamp is reduced from 35 to 25 cents each with a few renewal privileges. Tungsten lamps of 40-watt, 32 cp will be supplied at a cost of $1, the 60-watt, 48-cp lamp for $1.25 and the 110-watt, 80-cp for $1.50. The company will put the lamp in the customer's sockets and will demonstrate that each lamp is in condition before the customer is required to pay for the lamps. Mr. Lieb handed the following schedule to the commission:

PRICE OF INCANDESCENT LAMPS.

Cp.	Type.	Watts.	Prevailing retail price. Plain.	Prevailing retail price. Frosted.	Extra price charged to renewal customers.
16	Carbon	50	$0.20	..	Free renewal
32	Carbon	100	.30	..	Free renewal
20	Gem	50	.25	..	Free renewal
20	Tantalum	40	.60	$0.62½	25c. or 27c.
25	Tantalum	50	.60	.62½	25c. or 27c.
32	Tungsten	40	1.50	1.55	$1.00
48	Tungsten	60	1.75	1.82	1.25
80	Tungsten	100	2.00	2.10	1.50

Mr. Lieb stated that the above list covers the best tungsten lamp as yet put on the market. Probably before long a tungsten lamp of lower power than the 32 cp will be procurable in this country, he said, and the company will follow the development of the lamp and give its customers the benefit of decreases in prices which will probably ensue with increased manufacture of the lamp. In order to make the situation clear with reference to the relative status of the various types of lamps, Mr. Lieb had prepared the following table, which he submitted to the commission:

COST TO CUSTOMER OF 10,000 CANDLE-HOURS OF ILLUMINATION.

Cp. of lamp.	Type of lamp.	Watts.	Cost of lamp.	Kw-hours of current consumed.	Current cost.	Lamp cost.	Total cost.
16	Carbon	50	Free renewal	31.25	$3.12	$0.000	$3.12
20	Gem	50	Free renewal	25.00	2.50	0.000	2.50
25	Tantalum	50	Extra 25c.	20.00	2.00	0.125	2.125
32	Carbon	100	Free renewal	31.25	3.12	0.000	3.12
32	Tungsten	40	Extra $1.00	12.50	1.25	0.312	1.562

Mr. Frank W. Smith, of the United Electric Company, stated that his company was prepared to make the same arrangement with its customers as the Edison Company. Mr. Smith said that it might be possible for a consumer using the tungsten lamp to be compelled to pay a higher price for current than formerly owing to the fact that the decrease in current consumption might remove him from the wholesale to the retail class. Mr. C. G. M. Thomas, of the New York & Queens County Com-

pany, stated that his company was prepared to furnish the tungsten lamp on practically the same basis as the other companies.

Before the hearing on May 20 the companies will prepare schedules which will show how many wholesale consumers might be forced to come into the class of retail consumers, owing to decreased consumption of current, brought about by the use of the new lamps.

Edison Leading-in Wire Lamp Patent Declared Invalid.

On May 14, Judge Buffington, in the United States Circuit Court, sitting in Pittsburg, handed down an opinion declaring invalid the Edison patent on leading-in wires for incandescent lamps, which, several years ago, figured so largely in litigation against incandescent lamp manufacturers. The patent (No. 444,530) was issued originally Jan. 13, 1891, and reissued (No. 12,393) Oct. 10, 1905. It relates to the use of a small length of platinum wire entirely sealed in the glass, to which are soldered outer and inner leading-in copper wires. Formerly the entire wire between the filament and the socket was of platinum, whereas by the means described in the patent the length of platinum is reduced to about a quarter inch for each side of the leading-in circuit.

The court held that the location of the Edison joint, while ingenious, useful and practical, was but a mechanical improvement. "He did not discover a copper-platinum joint could be made in a seal without destroying its integrity, but by correcting a false notion as to the effect of such a seal at its other end, he broadened the sphere of use of such seal. It was one of those mechanical advances which the increased cost of platinum and closer study of manufacturing problems naturally brought about." The decision was that the patent is void.

The litigants in the case were the Edison Electric Light Company and the Novelty Incandescent Lamp Company. As the patent expired in January of this year, the only effect of the decision is to preclude the recovery of damages in this suit and in other suits pending. The point on which the decision was based is only one of a number that have been advanced during the litigation of the patent, another being that the same joint was used by Heisler before the period which the patent was claimed to cover.

Long Acre Franchise Assailed.

The attack on the franchise of the Long Acre Company was continued by the Anti-Monopoly Company, represented by Alfred J. Talley, at the hearing held May 8 by Commissioner Maltbie in the matter of the application of the Long Acre Company for authority to issue $10,000,000 of preferred stock and $50,000,000 of bonds. An affidavit of Mr. John S. Walsh, secretary of the Anti-Monopoly Company, in which permission was asked from the courts for the power to examine Mr. William H. Kelly, was placed in evidence. According to the affidavit, the Anti-Monopoly Company was incorporated in New York on May 24, 1905, with power to manufacture and sell gas and electricity. The affidavit recites that Martin F. Minturn, as agent and trustee for John J. Moore and William H. Kelly, came into possession of the franchise, now held by the Long Acre Company, on or about Oct. 1, 1898, and that Martin F. Minturn had bought the franchise at a receiver's sale at the instance and request of John J. Moore and William H. Kelly. Mr. Minturn delivered a blank assignment of the franchise to Mr. Kelly, and the latter, inserting the name of the Long Acre Company in the blank space, delivered the franchise to the company. The affidavit alleged that this was a fraudulent act on the part of Messrs. Minturn and Kelly and in violation of the rights of Mr. Moore, and that the Long Acre Company was a party to the fraud. In July, 1902, John J. Moore transferred his alleged half interest in the franchise to John D. Moore, who transferred it, in June, 1905, to the Anti-Monopoly Light & Power Company. Mr. Minturn died in the spring of 1907, and Kelly could not be found when he was needed for examination.

Mr. Talley delivered a long speech to the commissioner in which he said that in the previous testimony before the commission there had been the most palpable kind of evasion of the efforts of the commission to find out who the real persons at interest were in the transfer of the franchise to the Long Acre Company, in which transaction "the Manhattan Transit Company acted as broker. The Manhattan Transit Company could not come before this commission," Mr. Talley said, "asking for leave either to operate this franchise or for an issue of $60,000,000 worth of securities, because it did not have the power under its charter. So it comes in the guise of the Long Acre Company. It is not the Long Acre Company with certain powers allowing it to create and sell electricity in this city; it is the Manhattan Transit Company, without the right to do what you are now asked to give permission to do, through the agency of the Long Acre Company." Mr. Talley paid his respects to the Edison Company by saying that he had looked in vain in the letter submitted to the commission by the Edison Company for any protest against the granting of the application, that bore the stamp of sincerity, and he added that the Consolidated Gas Company would welcome the granting of the application because it could acquire, by going to one person, George E. Bouchie, trustee for the Manhattan Transit Company, control of 490 shares of stock of the Long Acre Company's 500 shares, and then float $60,000,000 of securities.

In reply the counsel for the Long Acre Company presented a deposition from William H. Kelly, in which Mr. Kelly said that he did not know John L. Walsh, and that the statement in the affidavit made by Mr. Walsh that the franchise granted to the American Electric & Manufacturing Company was vested in Martin F. Minturn as agent for himself and John J. Moore was absolutely untrue, and that Mr. Moore had no direct or indirect interest in a franchise. The allegation that any act was done in fraud or violation of the rights of John J. Moore was absolutely untrue, Mr. Kelly deposed. Commissioner Maltbie stated that the question of the validity of the franchise was one for the courts to decide.

At the hearing on May 12, Mr. A. J. Dittenhoefer, of the law firm of Dittenhoefer, Gerber & James, testified that John J. Moore had said he had an arrangement with Judge Kelly whereby he (Moore) was to receive a share in the profits from the sale of the franchise, but he did not say that he owned any interest in the franchise. David Gerber, of the same law firm, said that the franchise had been in possession of his firm from six to eight years before it was sold. He said he had negotiated the sale of the franchise to Mr. Sheehan. He testified that he had talked with John J. Moore and that Moore said he was trying to sell the franchise for Judge Kelly on a commission basis, but he never asserted a title or claim to the franchise. The original assignment of the franchise in question from Martin F. Minturn to the Long Acre Light & Power Company was shown, and Mr. Gerber testified that it has the document which had been signed by Mr. Minturn and that there was no blank in the body of the assignment; but that he (Mr. Gerber) had dictated the whole document. He said that his firm received about $60,000 in bonds as payment for legal services. Various attempts had been made to sell the franchise, including a conversation with a representative of the Edison Company. Mr. Gerber said he considered the franchise worth much more than $500,000, but more could not be obtained for it when it was sold.

An affidavit signed by John J. Moore stated that when Mr. Minturn bought the franchise he was acting as agent and trustee for Mr. Moore and Mr. Kelly, and that the statement made that he, John J. Moore, had no interest directly or indirectly in the franchise was unqualifiedly false.

At the hearing on May 15, Mr. Talley stated that the Anti-Monopoly Company intended to bring a suit in equity to prove its claim to a half interest in the Long Acre franchise, since the question of the validity of the franchise or the ownership of it was not within the jurisdiction of the commission.

Another opportunity will be given on May 23 to those who wish to appear before the commission in opposition to the application of the Long Acre Company.

Detroit Meeting of the American Society of Mechanical Engineers.

The semi-annual meeting of the American Society of Mechanical Engineers will be held in Detroit, Mich., June 23 to 26. An entire session will be devoted to papers on the conveying of materials, and hoisting and conveying machinery, including belt conveyors, the use of conveying machinery in cement plants, etc., will be discussed.

Among other subjects which will be taken up by professional papers are "Clutches," with special reference to automobile clutches, by Henry Souther; "Some Pitot Tube Studies," Prof. W. B. Gregory, of Tulane University, New Orleans, La., and Prof. E. W. Schroder, of Cornell University; "Thermal Properties of Superheated Steam," by Prof. R. C. H. Heck, of Lehigh University; "Horse-Power, Friction Losses and Efficiencies of Gas and Oil Engines," by Prof. Lionel S. Marks, of Harvard University; "A Journal Friction Measuring Machine," by Henry Hess, of Philadelphia; "A Simple Method of Cleaning Gas Conduits," by W. D. Mount; "A Rational Method of Checking Conical Pistons for Stress," by Prof. G. H. Shepard, of Syracuse University; "The By-Product Coke Oven," by W. H. Blauvelt.

A lecture on "Contributions of Photography to Our Knowledge of Stellar Evolutions" will be delivered by Prof. John A. Brashear, of Alleghany, Pa. The usual receptions will be held and excursions will be made to manufacturing plants, shipbuilding yards and various points of interest in and around Detroit. Among the excursions planned is one to the University of Michigan, at Ann Arbor. The Gas Power Section of the society will hold a session, and the Society for the Promotion of Engineering Education and the Society of Automobile Engineers will hold a meeting in Detroit at the same time. As far as possible, sessions will be arranged so that members interested in subjects treated by the other societies may attend their sessions without missing papers on related subjects read before their own society.

Machinery Club of New York City.

Situated on the two topmost floors of the Fulton Building of the Hudson Terminal Buildings, 22 stories above the downtown section, the Machinery Club of the City of New York promises to become the largest business men's club in the city. The formal opening of the clubrooms will occur May 21, but already the membership is in excess of 1100. The constitution provides for 800 resident members, 250 suburban members and 2000 non-resident members. Although the club was ostensibly founded in the interests of the machinery and metal trades, its constitution admits to membership "any male person of the age of 21 years or over, and of good character." A large number of members connected with the various electrical interests have been enrolled.

No expense has been spared in fitting up the rooms of the club, a total of $125,000 already having been expended in furnishings and equipment. On the first floor is the main dining room, 50 ft. x 150 ft., finished in a light tone and with mahogany furniture, seating 500; also a Flemish grill room with its great round table of Mexican mahogany, bearing the name of the "talk table," because each diner who sits there is expected to converse with his neighbor. On this floor is also a large hall, offices and a smoking and lounging room. The second floor is given up to a ladies' dining room, with roof garden, and the main kitchen and servants' dining rooms with a roof garden. Still another roof garden is situated at the end of the hall, making five on the second floor, all of which command a superb panorama of New York City and the surrounding country. The club has its butcher's shop, bakery, storeroom, ladies' reception room, shower baths and lockers for out-of-town members who wish to dress for the evening, barber shop; in fact, every convenience of the best modern clubs. The furniture was specially constructed, as well as the glass and silverware; the Haviland china was imported from abroad and the linen made specially in Ireland. The lighting throughout is by tantalum lamps. Nine motors operate an automatic dish-washer, the dumb waiters, buffing and knife-cleaning machines and the ice-cream freezers. The club telephone system has five trunk lines and all the clocks are electrically regulated by Western Union time.

"The work of organization began about a year ago," said Mr. F. H. Stillman, founder and president of the club, "at the time when the tearing down of the buildings which stood on the site of this building, scattered the machinery interests which had centered in this neighborhood. The fact that the drug, dry goods and other business interests had clubs of their own, and the necessity for some recognized center for the metal and machinery trades, made the plan for a machinery club seem practicable, and that 60 per cent of the tenants of these two buildings are identified with machinery interests made it logical that the club should be situated here. The club will be especially appreciated by out-of-town members, who will now have a place to go where they will feel at home and will have an opportunity to meet, other than in a business way, the men interested in their lines of business. There are 20 charter members. Army and navy members are admitted without initiation fees and at nominal dues." The officers of the club are: Mr. F. H. Stillman, president; Mr. R. C. McKinney, vice-president; Mr. Walter L. Pierce, treasurer, and Mr. W. Seton Henry, acting secretary. The governors are: Messrs. O. C. Gayley, George A. Post, Walter L. Pierce, F. H. Stillman, C. A. Moore, H. L. Shippy, T. N. Motley, Henry Prentiss, H. B. Kirkland, W. P. Pressinger, A. B. See, W. H. Marshall, R. C. McKinney, E. H. Wells, W. L. Saunders, Otis H. Cutler, J. R. Vandyck, Kenyon B. Conger, William B. Albright and Chas. A. Schieren.

Training Naval Electricians.

For the purpose of training men to operate and care for the many types of electrical machines and apparatus used for various purposes on board of a modern warship, and for wireless telegraph and telephone service, the United States Navy maintains two electrical schools, one located at the Navy Yard in Brooklyn and the other at the Mare Island Navy Yard, near San Francisco, Cal. The students at these schools are men who have been regularly enlisted for a term of four years for the electrical department. Men are enlisted with the rating of electrician, or any specially skilled mechanic with some knowledge of electricity, or a student of electricity who shows aptitude for the naval service may be enlisted as landsman and later, upon qualification, will be advanced to the rating of electrician.

There are four classes of electricians in the naval service, namely, electrician third class, second class and first class, and chief electrician, the corresponding monthly pay for the several grades being $30, $40, $50 and $60. After having served one year on a sea-going ship the pay of chief electricians is increased to $70 per month, and upon re-enlistment all grades are given four months pay as a bonus and receive, in addition to the pay of their grade, $6.36 a month for the first re-enlistment, and an additional $4.36 a month for each enlistment thereafter. Every person, when enlisting, is provided by the government with an outfit of clothing amounting to $60, and there are no expenses for board, lodging and medical attendance while in the service, the only necessary expenses being for renewal of articles of clothing.

After enlisting, electricians are sent to one of the two electrical training schools above mentioned, where they are instructed in the use of electrical apparatus and appliances and also in wireless telegraphy and wireless telephony, all books and material used in this instruction being furnished gratis. The course of instruction is both thoroughly practical and up-to-date with respect to all electrical applications on board ship. At the New York Navy Yard there is for purposes of instruction a complete equipment of modern dynamos, motors and electrical apparatus, together with wireless telegraph and wireless telephone installations.

The qualifications for enlistment of an electrician of the third class is that he shall have had a practical experience of two years as a wireman and six months as a dynamo and engine tender; or two years as a dynamo and engine tender, together with switchboard operating experience; or two years of technical training in electricity. If, however, the candidate for electrician enlists as a landsman, the practical experience required is reduced to at least one year's work as a wireman in house, telephone, lighting or traction work; or a training as a telegraph operator, with one year electrical experience; or that he shall be a high-school graduate who is a student of electricity; or a graduate from a two years' engineering course on the nautical training ship. The entrance examination for electrician, third class, relates more particularly to practical subjects, the only exceptions being questions as to the definition of the four electrical units and the solution of simple problems in fractions and decimals. The instruction is carried on in five sections, namely, theory section, mechanical section, practical electricity section, ship's watch section, wireless telegraph section. The entire course extends over 21 weeks and is followed by a final examination covering the work of the entire course. A series of illustrated lectures is given covering the school work, but practical instruction is, so far as possible, individual. The home of the students is on board the receiving ship, where there is an excellent technical and general library. After completing the course, the electricians are sent either to cruising ships or to wireless telegraph stations on shore, their term of enlistment being frequently divided between these two classes of service. Lieutenant-Commander R. H. Leigh, U. S. N., is in charge of the electrical instruction at the New York Navy Yard.

Lightning Arrester Performance.

Two papers dealing with lightning arresters were presented at the meeting of the American Institute of Electrical Engineers, held on May 19. Mr. J. F. Vaughan related the results of comparative tests of lightning protective devices on the 50,000-volt Taylors Falls transmission system. Mr. N. J. Neall discussed the data gained from the above tests and from tests made on the system of the Presumpscot Electric Company, which supplies energy at 11,000 volts to the Cumberland Mills, near Portland, Maine.

The results of the Taylors Falls experiments indicate that the principal trouble is from temporary or permanent breakdown of line insulation by static charges induced in the line by passing storms. The induced charges are highly concentrated, and often of immense volume and intensity, discharging to ground over insulators with a disruptive effect that tends to shatter, but rarely to puncture, them. The disturbances may occur anywhere on the line, but the preference is for exposed heights and to a less degree for wet low lands.

There was no evidence of surges other than the direct effects of grounds or short-circuits nor of stress at any definite points on the line, such as from reflected or standing waves. Overhead grounded wires are of decided value in shielding the line from induced static charges and in preventing insulator breakdowns. A grounded conductor running down the pole is of decided value in preventing splintering of the pole.

The shunted-resistance multigap type of arrester is effective in disposing of ordinary disturbances. The aluminum-cell type of arrester is, in general, more sensitive and freer in discharge; it gives great promise for station protection. Horn-arresters of the series-gap and selective-resistance type are of special value as emergency devices to relieve the station arresters in case of abnormal discharge. They may be adjusted to be fairly sensitive without causing interruption to the service.

Mr. N. J. Neall, after reviewing the experiences on the Taylors Falls and Presumpscot systems, expressed the opinion that a grounded wire suspended along a line will tend to absorb an electric charge. It is desirable to place one, two or more wires above the line wires, the former wires being grounded at each pole near stations and important places. When an overhead grounded wire is used exclusively for station protection, it should be not less than two miles in length and be grounded at each pole. Lightning rods added to the overhead grounded system probably add to the protection.

The shattering of insulators is liable to occur in every severe lightning storm, but not in mild ones.

Insulators should be so designed as to withstand at least twice normal voltage between line and pin; the equivalent spark-gap of the insulator should be higher than that of any arrester path to ground on the line. Horn-type arresters should be employed for extraordinary service only. A wood pole may be effectively protected against splintering from lightning discharge by providing it with a small metallic conductor connected to ground.

For station protection electrolytic lightning arresters have operated creditably, but they have not shown complete superiority over other types. When the external lines are fully protected, as by the use of overhead grounded wires, the station apparatus is also protected thereby.

Convention of the Southwestern Electrical & Gas Association.

The fourth annual convention of the Southwestern Electrical & Gas Association was called to order on Thursday morning, May 7, by President H. T. Edgar, in the St. Regis Hotel at El Paso, Tex. The address of welcome was delivered by Mayor Joseph V. Sweeney, of El Paso, and responded to by Mr. H. S. Cooper, of Galveston.

In his annual address President Edgar gave a résumé of the work of the association, and made the following recommendations:

1. That meetings of the executive committee be held at least twice a year. 2. That the expense of the secretary in collecting and classifying data regarding taxes, donations, etc., be paid by the member companies, and also that the secretary arrange in the future to collect and classify other information of general interest to the members of the association. 3. That the past records of the association be printed and sent out to the members. 4. That future conventions always arrange suitable exhibit space to be furnished free for the use of associate members. 5. That an assistant secretary be appointed to be paid by the secretary, and to maintain an office in Dallas, Tex. 6. That certificates of membership be furnished to the members of the association, with the request that they be framed and put up in their respective offices. 7. That a committee of four be appointed for the purpose of fostering closer relations with the national and other societies. 8. That a committee on municipal ownership be appointed.

These recommendations met with the hearty approval of a committee appointed to take action on the president's address.

A paper by Mr. Marsh Lowd, of the Stone & Webster Engineering Corporation, entitled "Track Construction," was read by Mr. C. H. Ladd. This paper outlined the advantages of the T-rail. After discussion by Messrs. Ladd, of Fort Worth; Kellogg, of El Paso; Edgar, of Fort Worth, and Brown, of San Antonio, and upon suggestion of Mr. Cooper, a committee was appointed, with Mr. Fred. M. Lege, of Galveston, as chairman, to frame a communication to be presented to the national organization at its meeting in October in regard to the desirability of standardizing a high T-rail.

A paper on the testing of gas meters was presented by Mr. J. A. Myler, Jr. The paper contained many hints relating to the operation and adjusting of meters.

The discussion, which was participated in by Messrs. A. E. Judge, J. A. Myler, H. S. Cooper, J. B. Conant, Frank Duffy and R. B. Stichter and Prof. A. C. Scott, covered the care and attention of meters, and the best ways of numbering and recording them.

The subject "What Policy Should be Pursued by Public Service Corporations in Making Extensions?" was discussed by Messrs. H. M. Moore, H. S. Cooper, E. L. Wells, C. W. Kel-

logg, W. B. Head, R. B. Stichter, H. T. Edgar and F. M. Lege.

The Question Box, a 188-page book bound in green cloth, which was edited by Mr. Samuel Kahn, of San Antonio, brought out the experiences of the members present in regard to the calorific value of oil and the method of handling fuel. Other questions regarding the use and advantages of steam turbines were freely participated in by the delegates. The subject of automotineers was discussed thoroughly, the various members relating their experience with them. This discussion was participated in by Mr. Duffy, Mr. Cooper, Mr. Kahn, Mr. Peel, Mr. Ing, Mr. Scott and Mr. Turner. The subject of arc head lamps was then taken up and discussed by Messrs. Peel, Kellogg, Cooper, Kahn, Edgar and Turner. The next question related to meters. This was participated in by Messrs. Cooper, Kellogg, Moore, Conant, Scott and Kelley.

A paper by Mr. W. B. Tuttle was devoted to gas producers and gas engines. The author gave data to show that Texas lignite can be used to advantage in gas producers. He described a process by which the exhaust gases are returned and introduced under the fuel bed in order to limit the temperature of the fuel. He claimed that by using this process the combustible consumed per brake hp-hour would be only 0.97 lb., as compared with 1.51 lb. required with the usual process. This paper was not discussed.

"Wood Preserving" was the title of a valuable paper read by Prof. Eugene P. Schoch. He reported the results of an investigation which showed that crude oil does not effectively preserve wood, except when used in sufficiently large quantities to exclude moisture from the wood. Of the other preservatives, namely, wood-tar distillates, poisonous salts of metals and coal-tar distillates, the last-named holds the highest rank. The mixture of tar oils known as creosote, which has long been in use, is undoubtedly effective. The value of creosote as a wood preserver is attributable to the oils of high-boiling temperature which, in addition to being germicidal, are quite permanent. This paper elicited an interesting discussion participated in by Messrs. Lee. Logan, Cooper, Gerhard, Kellogg, Ladd, Edgar, Carpenter, Stichter, Brown and Prof. Scatt. At a later session, on recommendation of the executive committee, Prof. Schoch was elected an honorary member of the association.

"Electric Illuminants and Their Efficiency" was the subject of a paper presented by Mr. C. W. Kellogg, Jr. The author showed that the renewal cost of a 32-cp, 3.1-watt carbon-filament lamp is .45 cent, and that of a 32-cp, 12.5-watt tungsten lamp is 2 cents per kw-hour of energy sold by the central station, and claimed that the latter cost is so high as to be prohibitive. He expressed the opinion that the method of charging for each high-efficiency lamp the difference in cost between it and the older carbon-filament lamp should be adopted. This plan will appeal to the customer because he will save $7.50 per 1000 lamp-hours by using the lamp of higher efficiency, and can well afford to pay $1 additional for the lamp. This paper was discussed by Messrs. Cooper, Kellogg, Rice, Moore, White and Gumm.

Prof. B. V. Swenson, secretary of the American Street & Interurban Railway Association, upon being invited by President Edgar, urged the members of the Southwestern Association to affiliate more closely with the former association. He commended the Southwestern Association for its ability to handle local matters in a way impossible in the general organization.

Upon recommendation of the committee appointed to select officers for the ensuing year, the following men were unanimously elected to the offices indicated: R. B. Stichter, president; W. B. Tuttle, first vice-president; W. B. Head, second vice-president; Joe E. Carroll, third vice-president; J. A. Myler, secretary, and A. E. Judge, treasurer.

From the standpoint of attendance, the convention was the most successful that has been held by the association. The total number in attendance was 140, of whom 27 were ladies. Thirty-six companies were admitted to membership during the convention. Handsome souvenir programs containing a history of the association and photographs of the officers were distributed to the members. From the proceeds of the advertising in the program, the minutes of the convention are to be printed in book form without expense to the association.

Electrical Engineering at Purdue University.

Two important changes are to be made in the curriculum of the School of Electrical Engineering at Purdue University during the coming year, which may be briefly outlined as follows:

Practice in the electrical laboratory covering the more elementary engineering tests on electrical machinery is to be given to the junior electrical engineers for the purpose of more closely connecting the theoretical work taken by this class with a practical knowledge of the fundamental laws of electrical engineering as applied to modern electrical equipment. This will, in addition, permit the introduction of more advanced tests during the senior laboratory course.

The subject of railway electrical engineering is to be introduced throughout the senior year. It is the intention of Prof. Harding, who has recently been appointed to the head of the School of Electrical Engineering, that this subject, together with additional railway work in the laboratory, act as a nucleus for marked development in railway electrical engineering at Purdue.

The records of the above university show that approximately 78 men will this year receive the degree of B. S. in electrical engineering, eight of whom are specializing in the telephone course. The graduate degree of E. E. will be conferred upon five in addition to the above.

Bleaching Flour by Electricity.

Mr. F. J. Postel, consulting engineer, addressed the noonday meeting of the Electrical Club, of Chicago, May 13, at the Grand Pacific Hotel breakfast room. The subject was "Bleaching Flour by Electricity," in which he reviewed briefly the history of this process and its objects. The art of bleaching flour in this way began with the discovery that flour when passed through air containing considerable ozone became bleached or whitened. Before this process came into common use among millers, flour was graded very much assording to its color, the whitest flour bringing the best price. With the bleaching process it is possible to sell naturally darker grades of flour at the best prices. Chemical analysis reveals no change in the flour due to the bleaching, although it is claimed that the bleached flour will keep and bake somewhat better than the unbleached.

According to Mr. Postel's history of the development of apparatus for manufacturing ozone and bleaching flour, considerable effort was wasted in the early days of process by lack of electrical knowledge on the part of the inventors. Much secrecy was maintained about the apparatus used in the process at first. Several rival companies came into the field with different apparatus for producing ozone, or nitrous acid. One of these is a chemical process. The companies exploiting electrical processes have all been absorbed by one company, the Alsop Process Company, of St. Louis. This company makes a simple outfit consisting of a small dynamo which is connected in series with an inductance coil. The circuit is made and broken by a reciprocating make-and-break device which also works an air pump for forcing air through the chamber in which the make-and-break occurs. This results in a series of flashes which generate ozone in the air being pumped through the chamber. The air is then piped to places where the flour is falling in streams for exposure to the gas. Another advantage which, from the consumer's standpoint, bleached flour has, is that the miller can use certain nutritive parts of the wheat in ordinary white flour which heretofore he was accustomed to eliminate from the best white flour because they made the flour dark and unsalable. Nearly all the best flour mills now employ bleaching processes and the introduction of electricity for this purpose has also served to get the millers better acquainted with electrical apparatus. This has in many cases resulted in the extensive application of electricity through a mill which formerly had no wires.

Break in the Hauser Lake Dam of the United Missouri River Power Company.

We published in our issue of April 25, among the general news items, a note to the effect that the Hauser Lake dam of the Helena Power Transmission Company failed on April 14. This dam is on the Missouri River, about 16 miles from the city of Helena, Mont., and additional information on the failure has just come to hand. The dam is 70 ft. high, 490 ft. long and was built of steel bents supporting curved steel plates forming the water face of the dam. Both ends of the latter were founded on the solid bedrock, but the greater part of it at the middle section was on a gravel foundation. The dam was anchored at the up-stream toe to Freistedt sheet piling, driven in the hard river ground. There was also a rubble-masonry fill at the up-stream toe located under the plates and down-stream from the sheet piling.

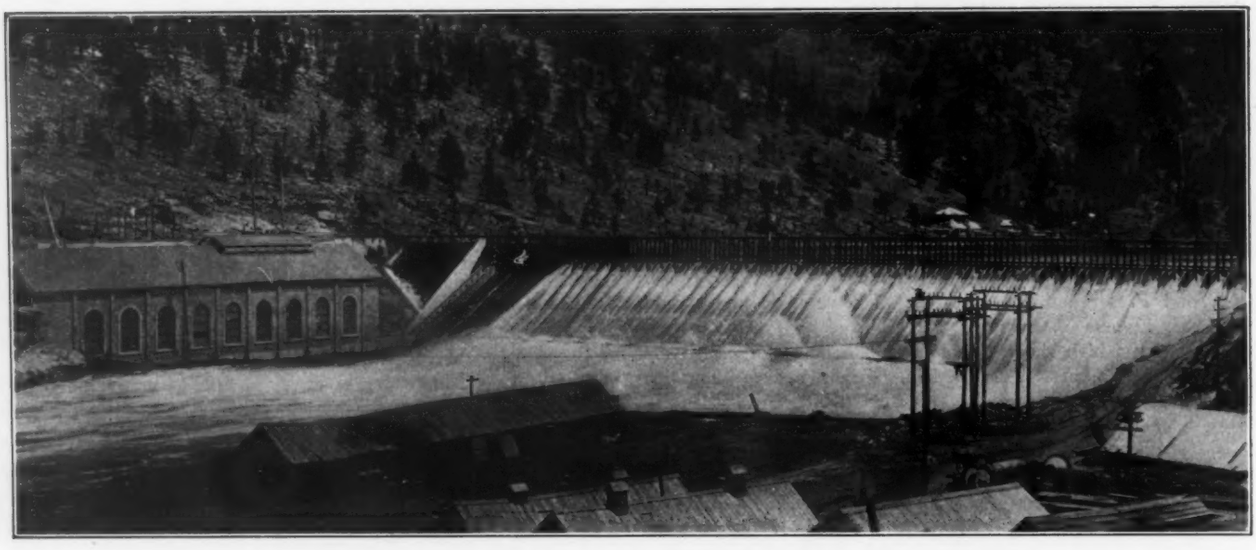


FIG. 1.—HAUSER LAKE DAM BEFORE THE ACCIDENT.

The initial break in the dam occurred about 400 ft. from the east, or power-house, end of the dam. The anchorage at this point apparently gave way, breaking the seal and allowing the water to pass under the rubble-masonry fill. The water rapidly cut away the gravel, permitting the settlement of this up-stream masonry and carrying down with it the lower end of the girder forming the upper member of the steel bent. The expansion joint in this girder and in the plates of the dam just above the top of the masonry gave way, leaving the bents and plates unsupported in such a manner that the water pressure pushed over this section. About six minutes elapsed from the time the water first came through under the rubble masonry until the expansion joint failed and the first bent toppled over, carrying out a section about 30 ft. in width. The tremendous rush of water rapidly widened this breach, the foundations on each side were undermined, and the posts and steel work buckled at right angles to the direction of the flow of the river. The bents continued to give way and fall until the breach widened to nearly 300 ft. The photographs show the break looking down-stream after the water subsided.

The acceptance of the dam had been refused by the engineers of the Helena Power Transmission Company. The matter was accordingly submitted to arbitration, and the builders have until very recently been making repairs and strengthening certain parts of the structure. At the time of the accident the matter of acceptance and final settlement was in the hands of the attorneys of the power company.

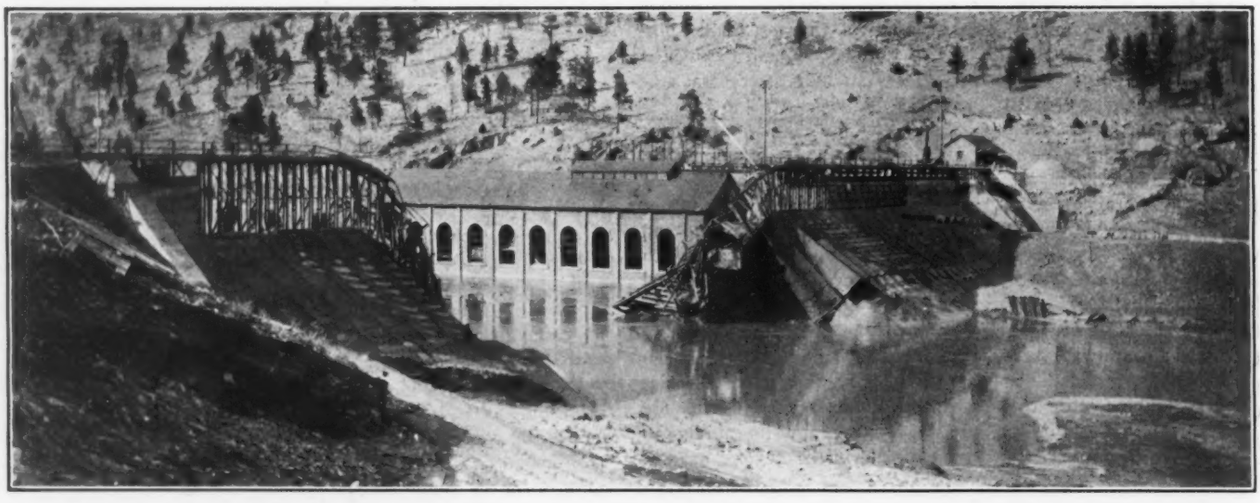


FIG. 2.—HAUSER LAKE DAM AFTER THE ACCIDENT.

Fig. 1 shows a view of the dam and generating station before the accident. Back of the dam is a lake 10 square miles in area. Structural steel trusses riveted to the crest of the dam serves the double purpose of supporting a foot bridge and holding the flash boards. The system of raising the height of the dam by

use of flash boards is similar to the one in use at the Canyon Ferry station and in addition steel gates 10 ft. wide and 10 in number were placed at the east end in a vertical position on the crest of the dam. These gates took the place of the flash boards for 100 ft. of the crest and were used for the purpose of regulating the flow of the river when the flash boards were in place. On the east side of the river is a forebay 227 ft. long and 45 ft. wide at the intake. Openings are made in the west

FIG. 3.—SIDE VIEW OF WRECKED DAM.

wall of the forebay for five gates and penstocks through which water is conducted to the turbines. There are also three openings in the north wall to penstocks conducting water to three exciter turbines. The power house, which is constructed of masonry and steel, is 212 ft. long by 52 ft. wide. The installation consists of five pairs of turbines operating on horizontal shafts direct connected to five, three-phase, 2400-volt, 2800-kw Westinghouse generators. On the north end of the generator room is a gallery for the switchboard and beyond is a room for the transformers which contains three banks of step-up transformers having an aggregate rating of 18,000 kw. Energy

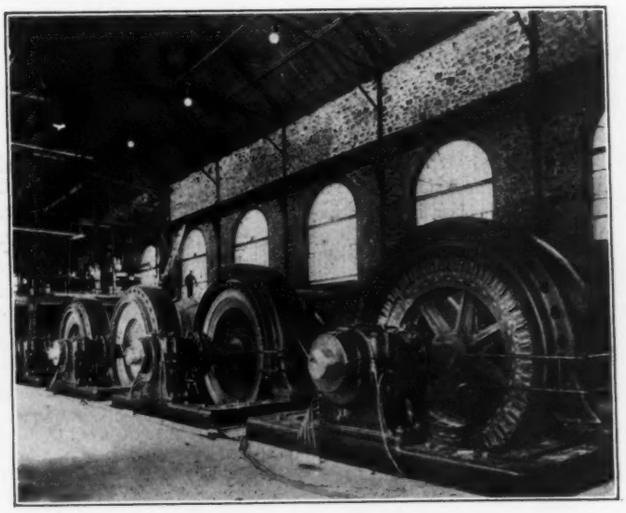


FIG. 4.—INTERIOR OF POWER HOUSE.

at a potential of 60,500 volts connects with the high-tension lines of the Missouri River Power Company, about 16 miles distant, for transmission to Butte and Helena, the equipment being operated in parallel with the plant of the Missouri River Power Company, located at Canyon Ferry, Mont., also on the Missouri River. The power house and machinery at the Hauser Lake dam sustained but very little damage. The electrical machinery has been dried out and it is estimated that the total loss to the power plant will not exceed $5,000.

At the time of the failure the energy delivered from the station was being used in the Butte mines and smelters, but the auxiliary steam plant located at Butte was immediately started, and this plant, together with the hydro-electric development at Canyon Ferry, is carrying practically all of the load, so there has been no serious interference with operations at Butte, nor at Anaconda.

The electrical energy for the city of Helena is supplied entirely from the Canyon Ferry plant, so there was no interruption of service in that city. The total damage has been variously estimated from $250,000 to $300,000, and the time to make the necessary repairs at about six months. The dam, it is reported, will be immediately repaired.

American Electrochemical Society.

In our issue for May 9 was published an account of the recent meeting of the American Electrochemical Society at Albany, together with abstracts of several of the papers presented. Abstracts of other papers follow.

In a paper by Richard H. Gaines, the specific case of the corrosion of the Rochester steel conduit was discussed. There was absolutely no evidence that external currents, like the stray currents from tramways, entered the steel conduit, and it appeared to be a case of corrosion due to irregularity in composition and structure of the steel surface, aided by the nature of the surrounding soil and excessive moisture and to an inadequate protection of the steel surface from corrosion.

Both the address of Prof. Burgess and the paper of Mr. Gaines elicited a very extended discussion, in which Messrs. Acheson, Bancroft, Carhart, Grower, Hering, Lidbury, McElroy, Potter, Sharp and Wolff participated. Mr. Acheson referred to the fact that deflocculated graphite protects iron surfaces, at least to some degree, against corrosion. Dr. Bancroft urged that the e.m.f. existing between different points of a steel surface indicates only the tendency to corrosion or the beginning of corrosion. For its progress the formation of a surface film may become highly important. The question how far liability for damage done to water and gas pipes may be settled upon tramway companies was brought up by Dr. Carhart and Dr. Sharp. Dr. Sharp emphasized that there are two causes of corrosion: first, electrolysis due to stray currents, and, second, local voltaic action. There is great liability to self-deception in the use of the voltmeter as it is often employed.

The situation, serious as it is, has become even more serious by tests (called "electrolytic surveys") carried out by some so-called experts in a ridiculous manner. Dr. Potter thought that the only way of overcoming the difficulty would be to eliminate the electrolyte by using an impervious non-conducting coating on all steel pipes and structures embedded in earth.

ALUMINUM.

A paper on the commercial applications of aluminum was presented by Mr. E. Blough. Aluminum is used either alloyed or pure. Practically all castings are made from alloys. Among the applications in the electrical industry, the author mentioned electric meter frames, meter covers, etc. Large quantities of aluminum are used for deoxidizing steel to produce sound castings.

Sheet aluminum is made hard and soft and rolled in all gages from very thick to very thin. Sheet aluminum and aluminum tubes are used for many purposes in the chemical industries, in paper and pulp mills, etc. The use of aluminum for high-tension feeders and busbars is also increasing. As to the combination of aluminum with other metals, the author mentioned copper lined with aluminum for use in surface steam condensers and bi-metallic wire, which is a steel wire coated with aluminum. He also exhibited the different steps in the manufacture of aluminum cooking utensils from an aluminum sheet by drawing and spinning into the finished article.

COPPER ANODES IN CHLORIDE SOLUTION.

A paper by Mr. Saul Dushman on this subject was of a theoretical and experimental nature, the object being to investigate in detail the conditions under which the copper passes into solution as cuprous or cupric salt. There are two different equilibria at the anode, and the constants of equilibrium were determined. By a special arrangement of the electrolytic apparatus, the concentration phenomena at the electrodes were determined.

ELECTROCHEMISTRY OF LIGHT.

On the evening of Thursday, Prof. Wilder D. Bancroft presented an experimental lecture on the chemistry of light. The gist of his extended discussion was the proof that Grotthuss' theory of photochemistry explains all phenomena he knows. Grotthuss has developed two fundamental laws of photochemistry. The first is that only those rays which are absorbed can produce photochemical action. The second is that the action of a ray of light is analogous to that of a voltaic cell. Many examples were given by Dr. Bancroft to explain this second law. One conclusion is that the presence of a depolarizer increases or makes possible the action of light. Whether any given substance is reduced or oxidized by light depends on the depolarizer. In many cases of oxidation by oxygen gas, the oxygen acts as a depolarizer. When chlorine acts with silver or bromine with toluene, it is the halogen that is made active by light. The paper was discussed by Dr. Baekeland, Dr. Baskerville, and Prof. Burgess.

WATER POWER IN THE ADIRONDACKS AND FOREST RESERVATION.

The last paper of the Thursday evening session was presented by Mr. Edward R. Taylor on "Forestry, Water Storage, Power and Navigation." The author discussed the damage done by disastrous floods. While something may be done by reforesting our mountains, this will not solve the whole problem. To prevent the floods it is necessary to impound the water in lakes in the headwaters. This will cost money, but will place at our disposal vast water powers. The author called attention to the immense water-power possibilities of New York State, which he considered worth more than all the coal mines of Pennsylvania.

KINETIC MOLECULAR ENERGY.

The first paper of the Friday session was presented by Dr. Charles Proteus Steinmetz on kinetic molecular energy. The speaker showed in an exceedingly suggestive way how it is possible to develop the thermodynamical gas laws as the consequence of the elementary principles of mechanics of irregular molecular and intramolecular motion, taken together with the rules of probability. Comparisons were made with astronomical phenomena, and the laws of cosmic motion were applied to molecular motion. In this way it is unnecessary to assume perfectly elastic bodies or collisions between them. The molecules or atoms describe paths around each other just as the suns, planets, etc.

From simple definitions of temperature and pressure on the basis of these views, Dr. Steinmetz derived the Boyle-Mariotte-Gay Lussac laws, Avogadro's rule, the laws of adiabatic change, etc., and explained on the basis of these views, together with the principles of probability, why heat always moves from higher temperature to lower temperature.

HEAT OF VAPORIZATION.

Dr. Joseph W. Richards presented a paper on "The Heat of Vaporization of Metals and Other Substances." He proposed the following generalization: The latent heat of vaporization of atomic weight is proportional to the absolute temperatures of the boiling point at atmospheric pressure, and is numerically equal to about 23 times that temperature (21 times, if the outer work of overcoming the atmospheric pressure be not included). From this rule it is possible to estimate the amount of heat necessary to vaporize any metal whose boiling point under atmospheric pressure is known.

ELECTROCHEMICAL PATENTS.

A paper on this subject was presented by Mr. A. B. Marvin, Jr., who gave a history of the Patent Office, and showed curves illustrating the increase in the number of electrochemical patents since 1860. The present conditions in the Patent Office are deplorable, due to an insufficient, underpaid and overworked force. The situation will not be improved until the Patent Office is reorganized. The paper was discussed by Messrs. Baekeland, Potter, Raegener and Steinmetz. Mr. Louis C. Raegener declared with great emphasis that what is really needed is a reform in our patent laws. Our present laws afford no protection whatever to the inventor. They are only good for the patent attorney.

IRON TESTS DURING ANNEALING.

Mr. E. E. F. Creighton described a method for the magnetic testing of iron during annealing. The iron is simultaneously heated and tested for its magnetic properties. The decrease and disappearance of magnetism with rising temperature was observed, and the corresponding tests were then made with the temperature being decreased again. It seems that gases occluded in iron may greatly affect the electric and magnetic qualities of iron. Nitrogen seems specially obnoxious. This may explain the different behavior of steels of apparently the same composition made in the open-hearth and in the Bessemer converter. The paper was briefly discussed by Messrs. Burgess, Richards and Steinmetz.

HARE'S ELECTRIC FURNACE.

A paper by Dr. Charles A. Doremus described an early electric furnace of Robert Hare, formerly professor of chemistry at the University of Pennsylvania. At the age of 20, Hare invented, in 1801, the oxy-hydrogen blowpipe. In 1840 he described his first electric furnace and experiments made with it. It is a vacuum furnace, and it seems that he produced in it, with current from a primary battery, calcium carbide, phosphorus, graphite and metallic calcium. These products were, of course, obtained on a very small experimental scale, but the furnace was, nevertheless, larger than Moissan's first electric furnace (1892).

HYDROCYANIC ACID.

A paper by Mr. E. W. Smith and Dr. R. S. Hutton describes the direct synthesis of hydrocyanic acid and cyanides from carbon and gaseous mixtures, such as producer-gas containing nitrogen and hydrogen. No such high temperatures are necessary as has been thought before, so that it is possible to employ a resistor furnace, the gases being brought in contact with highly heated carbon. At temperatures above 1800 deg. C. the reaction proceeds readily, but it is necessary to withdraw the gases quickly from the high-temperature zone so that they can be cooled with sufficient rapidity to preclude their decomposition.

ELECTROCHEMISTRY AND THE CENTRAL STATIONS.

A paper by Mr. John Meyer on energy for electrochemical industries was briefly presented at the end of the Friday session. The author is collecting data which represent the conditions in the more important central stations so as to give exact information to electrochemists as to the hours at which energy could be supplied for electrochemical work at a very low cost. To be economically used, the electrochemical load must be a central-station equalizer and only such electrochemical processes are suitable in connection with central stations as do not require continuous operation. It is important for the central stations and electrochemical industries to get together.

CALCIUM.

Two papers dealing with metallic calcium were the first ones on the program of the Saturday session. A paper by Messrs. A. Hirsch and J. Ashton gives the conclusive proof that calcium can be alloyed with iron. However, it is necessary to carry out the alloying operation in a vessel under pressure so as to prevent the calcium from vaporizing at the required high temperature.

Dr. O. P. Watts and Mr. J. M. Breckenridge discussed the preparation of calcium alloys for use as a substitute for aluminum in the alumino-thermic reaction. The attempt to find substitutes for aluminum seems promising. The chief results are that alloys of calcium with aluminum and magnesium can be easily prepared up to a calcium content of 70 per cent. Alloys

containing 25 per cent of calcium or magnesium can be readily pulverized. In the absence of any considerable amount of silicon, alloys containing much calcium or magnesium react with explosive violence, but the addition of silicon renders the reactions quiet.

CONDUCTION IN ELECTROLYTES.

A paper by Dr. Louis Kahlenberg discussed the question as to the nature of electrolytic conductors. The author showed the limitations of the dissociation theory and emphasized that in the light of present evidence the vapor-tension of solutions does not afford any basis whatsoever of a correct view as to the nature of electrolytes as contrasted to non-electrolytes. When a metal is combined with elements of non-metallic character, the resulting combination may be an electrolyte or an insulator. However, far more experimental work is necessary on the subject of electric conduction in general and electrolytic phenomena in particular before we can hope for a real improvement of our theories of the inter-relation of electricity and matter, and our views of the process of electrolysis and the nature of electrolytic conductors.

ELECTRODELESS CONDUCTION IN ELECTROLYTES.

A paper by Mr. Carl Hering on the passage of direct current through electrolytes without the use of electrodes suggested some experiments which might decide certain questions as to the difference between electrolytic and metallic conduction, the ionic theory, etc. Several methods were described by which a direct current may be produced in a complete circuit of electrolytes without electrodes. This may be accomplished, for instance, by repeated induction with the same flux, making use of the result of the experiment recently described by the author in this journal, in connection with his criticism of the usual statement of the fundamental load of electromagnetic induction. Other arrangements by which a direct current in an electrolyte may be produced are also described, but these methods have not yet been employed experimentally. The paper was discussed by Messrs. Bancroft, Breed, Burgess, Lidbury and Richards.

REVERSED ELECTROLYSIS.

A paper by Mr. J. W. Turrentine discussed some apparently abnormal results obtained in electrolysis, for instance, the evolution of oxygen at the cathode, the deposition of gold on the anode, etc. The reasons of this abnormal behavior were discussed and explained. The paper was discussed briefly by Messrs. Betts and Lidbury.

DRY CELLS IN IGNITION SERVICE.

A paper by Dr. J. W. Brown discussed the use of dry cells in ignition service, and was illustrated by some interesting experiments. A great disadvantage with which the manufacturer of dry cells for ignition service has to contend is that he must not only produce an efficient and reliable battery, but also secure their use in batteries of proper size and in connection with efficient and economical ignition apparatus. As a matter of fact, over 90 per cent of the trouble experienced with battery ignition is due to the use of poorly-designed ignition apparatus or the use of well-designed apparatus badly adjusted. From the standpoint of efficient use of the dry-battery energy the usual types of timers are faulty in having excessively long contacts variable with the speed at which the engine is running, and the usual types of spark coils are faulty in requiring too high an amperage per spark and in producing too many sparks per explosion.

As to the battery itself, it must also be able to furnish a given quantity of electrical energy, and it must also be able to furnish it in the form of impulses of 2 amp. or more in rapid succession through a resistance of about 0.5 ohm. Dry cells of the well-known 6-in. type should not, except in case of emergency, be used in the form of a single series battery, but in the form of a series-multiple battery with as many as four sets in multiple whenever possible.

CORROSION OF BRASS.

A paper by Mr. W. S. Rowland discussed the electrolytic corrosion of aluminum-bronze by the more common sodium salts and sodium hydroxide. Unless caused by some additional chemical action, the changes in the rate of corrosion occur only upon the appearance or disappearance of a phase as shown in the equilibrium diagram.

A paper by Dr. A. T. Lincoln presented an account of researches on the electrolytic corrosion of the bronzes, made in continuation of his former extended work on this subject. He studied the corrosion of bronzes of different composition in sea water. The results are about the same as with sodium chloride.

REFINING OF IRON.

The last paper presented dealt with the electrolytic refining of iron, the author being Dr. E. F. Kern. The author has employed quite a number of different electrolytes and finds, for instance, that suitable deposits are obtained with chloride solutions.

The paper was discussed by Prof. Burgess and Prof. Richards. The latter emphasized that the time has come to start an electrolytic iron-refining industry, the product to serve as the starting material for carbon free ferro alloys.

With a vote of thanks to all who had made the meeting so successful and enjoyable, the convention adjourned. The next meeting will be held in October in New York City.

Steinmetz on Natural Resources.

Dr. C. P. Steinmetz delivered a lecture in the Engineering Societies' Building, New York, Sunday, May 17, before the students and friends of the New York Electrical trade schools, the subject of the discourse being "The Future of Electricity." He laid stress upon the rapid rate at which our natural resources are being depleted, and pointed out what a great future was thus being opened for electricity. The present generation will see the time when the hard coal deposits will be exhausted, and some now alive may even see the day when the remaining deposits of soft coal are so far underground that they will not be worth the expense of bringing them to the surface. He also referred to the impoverishment of the soil through exhaustion of the elements of fertility. In the future, electricity will be called on to meet these untoward conditions, which are menacing the inhabitants of the earth. As to fertilization, the processes for extracting nitrogen from the air are being perfected, and with cheap power they will afford an abundance of this element so necessary for plant life. Electricity will serve to solve the problem of utilizing fully the energy residing in the water powers of the earth. It was pointed out that in a single State —Massachusetts—there is more water power now going to waste than is available at Niagara Falls.

Dr. Steinmetz predicted that in the future there will be no more creeks and rivers, as these will be dammed at frequent intervals in order to utilize every drop of water, including that otherwise going to waste at flood time, and the courses of streams will be entirely dry at some seasons of the year. The power generated by this means will be used not only to replace that of heat prime movers, but will also serve for heating purposes. Dr. Steinmetz also spoke of the manner in which the more extensive application of electricity to traction will affect the social life of the coming generations, through enormously increasing the means of transportation. The over-population of cities, he said, will be relieved by the country becoming practically part of the cities. The latter are fast becoming merely places of business and sites for factories, office buildings and boarding houses for bachelors, while families are moving to suburban homes. The electric railway will also make it possible for farmers to draw upon the labor market of cities during the period of the year when they require extra help, men leaving their factory or other employment temporarily to go into the country. Dr. Steinmetz, in conclusion, expressed the opinion that the time may come when the government will have to take charge of all energy, human and otherwise, and direct it in order that the best conditions in life may be secured and maintained for the great populations of the future, deprived of many of the present gifts of nature.

CURRENT NEWS AND NOTES.

CONSOLIDATED GAS CASE ADVANCED.—The U. S. Supreme Court has advanced the hearing to Oct. 13 of the appeal of the city of New York and the Public Service Commission from Judge Hough's recent decision holding the New York State 80-cent gas law to be unconstitutional.

CONTINUITY OF EDUCATION.—On Tuesday, May 26, Mr. Frederick P. Fish will deliver an address on "Continuity of Education" before the graduating class and alumni of the School of Mines, Engineering and Chemistry of Columbia University. The meeting will be held in Havemeyer Building at 3 p. m.

STREET RAILWAY PASSENGER TAX.—The U. S. Supreme Court has affirmed the validity of a tax of one mill per passenger imposed by the city of St. Louis on the street railways of that city, the decision reversing the judgment of a lower court. The court holds that the ordinances under which the franchise taxes were assessed contained no expressed relinquishment of the city of the right to levy license taxes; and as the city and its charater has the power to impose a license tax, such a tax is therefore valid.

MORE WIRELESS STATIONS ON THE PACIFIC COAST.—Plans have been completed by the United Wireless Telegraph Company to install 11 new wireless stations on the Pacific Coast. The largest, a 5-kw station, will be at Ketchkan, Alaska. Seven will be installed on the transpacific steamships and three will be land stations, the location of which will be decided later. All except the 5-kw station will be 1-kw or 2-kw installations. At present trans-continental communication is only possible when the conditions are most favorable.

WESTERN MARYLAND HYDRO-ELECTRIC PLANT.—The Youghiogheny Light & Power Company proposed to erect a water-power plant of from 10,000 to 13,000 hp at Swallow Falls, Deep Creek and Muddy Creek Falls, near Oakland, western Maryland. The plant will be located in a district where 90,000 acres of coal land have been bought up by large operators, and it is expected that the plant will furnish power for networks of electric railways for the transportation of the coal mines, and for mining work.

COLUMBIA UNIVERSITY SUMMER COURSES IN ENGINEERING.—Columbia University will conduct, during the present summer, a number of engineering courses, work in which will count toward the degrees of the School of Mines, Engineering and Chemistry, and the degree of M.A. in the School of Pure Science. The courses, which will extend from July 7 to August 14, will be of a character to be of special interest to instructors in technical schools, to gradute students and to practicing engineers. In electrical engineering there will be six hours of lectures per week by Prof. C. O. Mailloux on "Electric Train Movement."

TIME-PIECES VS. ELECTRIC RAILWAY TIME-TABLES.—According to the *Spokesman-Review*, of Spokane, Wash., since the commencement of service on the Spokane & Inland Electric Railway between Spokane and Halifax, not a watch or clock has been sold along the right of way and jewelers have quit handling them, people depending upon the regularity of the electric railway service for determining the time. According to the report, those along the line who wish to know the time note the number of a car passing, and refer to the time-table to see when the car gets to the neighboring station.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION.—The third annual meeting of the Indiana Independent Telephone Association was held in Indianapolis, May 13 and 14. There was a large attendance and Mayor Bookwalter welcomed the delegates to the city. In his address President Lindemuth stated that there are 250,000 telephones in Indiana, of which over 200,000 are operated by 455 Independent companies, an increase of 16,000 telephones during the year. Several papers bearing on the telephone business were read. Mr. C. S. Norton, of Indianapolis, was elected president; and Mr. A. J. Payton, of Rockport, secretary-treasurer. Many manufacturers and supply houses made exhibits of apparatus.

ENGINEERS VISIT CEMENT WORKS.—A party of about 150, comprising members of the Brooklyn Engineers' Club, paid a visit to the works of the Edison Portland Cement Company, at Stewartsville, N. J., last Saturday. A special train left over the Lackawanna Railroad, stopping at Orange for Mr. Edison, who accompanied the party through the works. The output from the works is 8000 barrels daily and all the apparatus except the steam shovels at the quarries and the grinding rolls is operated by electric motors of the direct-current type. The power house contains three 800-kw, 250-volt generators, and there are, exclusive of fan motors, 235 motors in use in the plant, varying in size from 1 hp to 200 hp, the average size being about 25 hp. Arc and incandescent lamps are used throughout the buildings and yards and these are fed from a three-wire system. Although subjected to very severe usage, the direct-current machinery has given no serious trouble.

PRESERVATION OF FORESTS.—A bill has been introduced in the House of Representatives including an appropriation of $100,000 to enable the Secretary of Agriculture to supply to forest owners expert advice on the subject of reforestization. The Secretary is also authorized to enter into an agreement with the owners of forests on the head waters of any navigable stream whereby the government shall, for a period of years, care for such forests instead of the owner. The bill permits the States to enter into agreements with each other not in conflict with the Federal laws, and establishes a commission of five senators and five representatives to investigate the relation, if there be any, between the navigability of streams rising in the White Mountains, the Southern Appalachians and the preservation of the forests. If the commission should find that such relation exists it shall then determine if the United States should acquire land within the waters heads or whether the government shall exercise supervision over the waters heads without purchase.

WORK OF CARNEGIE INSTITUTION.—At an address on Monday evening before a meeting of the Phi Beta Kappa Alumni of New York, Dr. Robert Woodward gave an account of the work of the Carnegie Institution, of which he is the Director. At present, he said, 80 or 90 per cent of the income of the institution is devoted to promoting the physical sciences. Dr. Woodward referred to 10 large projects upon which the institution is already embarked. These lines of work are botanical research, with a laboratory in Arizona, where cacti and reforestation are the chief objects of study; economics and sociology, with the collection of materials for a social and economic history of the United States; experimental evolution, the laboratory for which is at Cold Spring Harbor, L. I; geophysics, a study of the conditions of rock formation; historical research, chiefly interested in getting together materials for an American history; marine biology, with a laboratory at the Dry Tortugas; meridian astrometry, a department which is compiling a catalogue of all fixed stars, from the brightest to those of seventh magnitude; nutrition, with a laboratory at Boston; the solar observatory at Pasadena, in charge of George E. Hale, and terrestrial magnetism, in which department is employed a ship which is cruising about the Pacific. For the Pasadena observatory, Dr. Woodward said, a telescope, the largest of its kind, with 60-in. lens, was being constructed, and that one with a 100-in. lens is being planned, by the generosity of a citizen of Pasadena, who gave $50,000. Dr. Woodward said that 1000 persons had been engaged in research work under the auspices of the institution since its establishment in 1902, and over 300 were thus engaged at present.

MUNICIPAL ELECTRICIANS CONVENTION.—The annual convention of the International Association of Municipal Electricians will be held at Detroit, Mich., Aug. 19, 20 and 21. Mr. Frank P. Foster, Corning, N. Y., is secretary.

CANADIAN ELECTRICAL ASSOCIATION CONVENTION.—The date previously set for the annual convention of the Canadian Electrical Association has been changed, and the convention will take place Wednesday, Thursday and Friday, June 17-19.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—The next convention of the Society for the Promotion of Engineering Education will be held in Detroit, Mich., June 22 to June 27, in conjunction with the meeting of the American Society of Mechanical Engineers. Mr. Arthur L. Williston, Pratt Institute, Brooklyn, N. Y., is the secretary.

MUNICIPAL PLANT SOLD.—The C. H. Geist Company, a gas and electric syndicate of Chicago, Ill., has purchased the electric light plant at East Chicago and Indiana Harbor, Ind., formerly owned and operated by the City of East Chicago. The company in the future will be known as the Indiana Harbor & East Chicago Electric Company, with the following officers: C. H. Geist, president; C. H. Weak, vice-president; C. W. Fox, secretary and treasurer.

WIRELESS FROM A BALLOON.—The U. S. Signal Corps conducted last week some experiments with wireless telegraphy from a balloon. A receiving wire was hung from the basket, which latter was covered with wire netting. With the balloon over Washington, wireless messages from Annapolis were clearly received. Major Edgar Russell, who had charge of the experiment, said that wireless telegraphy from balloons will prove most useful in warfare, as a balloon could float over a battleground and give the commanding officer exact details of every move made by the enemy.

NEW ENGLISH ELECTRICAL JOURNAL.—The first issue has appeared of the *Post Office Electrical Engineers' Journal,* which will be issued quarterly. A feeling among British telegraph engineers that their interests were no longer adequately served by the Institution of Electrical Engineers led recently to the foundation of the Institution of Post Office Electrical Engineers, and the new journal will be the official mouthpiece of this organization. The greater part of the contents of the first issue, which is dated April, relates to the telephone and wireless telegraphy.

RAILWAY TELEGRAPH SUPERINTENDENTS.—The Association of Railway Telegraph Superintendents will hold its next annual convention in Montreal, June 24, 25 and 26. Several papers pertaining to railroad telegraph service and others of general interest are scheduled. Among the latter are the following: "Dry Batteries on Telegraph Circuits," by U. J. Fry; "Wiring of Station Buildings From the Contractor's Standpoint," by J. H. Jacoby; "Adverse Railroad Legislation," by E. A. Chenery; "Moving Trains by Visible Signals," by L. B. Foley; "Use of Telephones in Connection with Train Movements," by W. W. Ryder; "The Interstate Commerce Commission," by C. Selden; "The Telephone," by F. F. Fowle.

CHINESE TELEGRAPH LINES.—According to a report recently submitted by Consul-General James W. Ragsdale, of Tientsin, 22,419 miles of telegraph lines were operated by the Imperial Chinese Telegraph Company in 1906. The system has 34,473 miles of wire, a submarine cable of 946 miles and 379 offices, of which 62 were open day and night, and 317 for day service only. The number of instruments was 768. At the head office in Shanghai the staff numbered 67 and the general staff 3175, while inspectors, linemen, etc., brought the total up to 2400. Besides the regular system there are in operation a number of provincial lines, usually constructed by the government, but operated and maintained by the provincial authorities.

TELEGRAPH COMPANIES TO BE INVESTIGATED.—Representative Cary, of Wisconsin, has introduced a bill into the United States House of Representatives directing the Secretary of Commerce and Labor to institute an investigation into the Western Union Telegraph Company and the Postal Telegraph Company to find out the methods used in handling the business, the wages paid operators and the working conditions of the employees. The results of the investigation are to be reported to the House as soon as possible. Mr. Cary started his career as a messenger boy in a telegraph office. His bill prohibits, under heavy penalties, telegraph companies from making discriminating rates in the same line of business. It permits leased wire contracts and newspaper rates at less than commercial rates, but requires that all business coming under a class, be charged according to the rates of the class under which it is listed.

GROUNDING OF THE SECONDARY.—In the annual report of the Wire Department of Boston, Mass., for the year 1907, Mr. James E. Cole, acting commissioner of wires, states that during the year there were no electrical fires due to wiring approved by the department, and with the exception of four fires in stations of the public service corporations, the total reported insurance loss for the electrical fires in the city during the year was but $166. Mr. Cole also reports that the grounding of secondaries has given good results in the city. Before the secondaries were grounded there were many cases of breakdowns in transformer insulations causing serious results. During the past year no damage has been caused by high-potential current entering buildings over secondary low-potential circuits, due to the proper grounding of the secondaries. He also states that there have been many cases where fires have been reported as caused by electric wires where there has been absolutely no justification for such report, there being no wires or electrical apparatus anywhere in the vicinity of where the fire occurred.

BOSTON Y. M. C. A. ELECTRICAL COURSE.—The School of Practical Electricity of the Boston Young Men's Christian Association is now in its fourth year of existence. There are two courses, one of 15 weeks and another extending over three years. The former requires an attendance of two and a quarter hours, three evenings in the week, and is intended to give as much theory as is necessary to the intelligent understanding of the principles which underlie the more common electrician's duties, together with as much practical experience in the handling of the various parts of all sorts of electrical equipment as can be crowded into this period. This course is intended for men who wish to obtain as much of a working knowledge as they can in a brief period, without attempting the far more complete study of theoretical principles and advanced matters which are given in the longer course. It appeals to men employed as steam engineers, janitors and others who are frequently called upon to perform certain lines of electrical work, as well as to those engaged in electrical work who know something along certain lines, but wish to obtain experience along other lines as well. The three years course is intended for men who wish to acquire as complete a knowledge of electricity as is possible but cannot attend a regular technical day school. It is intended to make the program sufficiently complete, both in theory and practice, to give the student an intelligent conception of electrical laws, electrical apparatus and electrical practice. The first year is devoted to mathematics, including algebra, geometry and trigonometry; physics, including lectures and laboratory work; mechanical drawing and theoretical electricity. A course in steam engineering, theory and practice, occupying one night per week, is also offered as an option to men attending the first year of the three-year course, but is not a part of the course. The fee for the short course is $35, and for the longer course $135 in all.

POWER IN PERU.—With regard to the recent statement that the first electrical energy transmission in South America was started in Peru in 1904, Mr. C. W. O'Farrell, of Cordoba, Argentine Republic, informs us that as early as 1897 or 1898 energy was supplied to the city by the Compania de Luz Electrica y Fuerza Motriz de Cordoba, at 10,000 volts over a transmission line 28 km long.

SPONGE-FISHING SUBMARINES.—Illustrations and description are given in a Parisian journal of a submarine intended for sponge fishing on the coast of Tunis. The vessel is built wholly of iron and is 16.4 ft. in length by 5.24 ft. in diameter, the general form being cylindrical with hemispherical ends. It is intended to carry two men, and is fixed so as to enable the vessel to move along the sea bottom. An electric lamp with reflectors fixed in front serves to illuminate the bed of the sea, and a glazed spy hole in the bow of the vessel enables the crew to seek out and to gather the sponges.

GRAPHITIC THERMO-ELECTRIC COUPLE.—In order to obtain an inexpensive thermo-electric couple for measuring temperatures of molten metals, Mr. W. H. Bristol employs for the two elements different forms, kinds or grades of carbon or graphite. These elements are capable of withstanding extreme temperatures and they do not appreciably alloy with most molten metals. In a patent issued April 21, it is stated that a particularly satisfactory couple can be made by using as one element pure carbon or graphite and combining from 15 to 20 per cent of Bavarian clay with carbon or graphite to form the other element.

STUDENTS GIVE AN ELECTRICAL AND MECHANICAL SHOW.—An electrical and mechanical show was given by the students of the mechanical and electrical department of the Washington State College, at Pullman, Wash., April 8 and 9. The show was very entertaining and instructive. There were many exhibits of scientific interest, such as a speaking arc, revolving field, a motor that would reverse its direction of rotavolving field and a motor that would reverse its direction of rotation every few seconds. X-ray and high-frequency apparatus were exhibited, and a 200,000-lb. testing machine was shown in operation. This is one of the largest machines west of the Mississippi. The attendance at the show was 2500.

ELECTRIC POSTAL TUBES.—According to advices from Berlin the German postoffice department has a scheme to connect the general postoffice in that city with the various branch offices by the construction of an underground railway, by which the distribution of the mail bags to and from the trains will be effected at a speed of about 25 miles an hour. The railway will be worked without a guard or driver, and the tunnel, placed close beneath the road surface, is to be only 29 in. in height by 71 in. in width. Each truck or car is intended for the conveyance of a large-sized mail bag. The complete train will be composed of a dwarf electric locomotive and not more than four trucks. The locomotive will have a pair of axles, each furnished with a motor. The line will be double track throughout, constructed on a 16.13-in. gage. Over each track will be conductor rails. A trench will be provided between the two lines of rails, so that a man will be able to pass through the tunnel. The construction of these tunnels for distribution of mails, the dispatch says, is regarded as a matter of certainty, as the negotiations between the postal authorities and city of Berlin have already been concluded. It will be interesting to see this "telpherage" method carried out, as it has already been seriously proposed more than once for New York City.

AWAKENED AFRICA.—Note is made of a remarkable feat of communication, in the current *Harper's Weekly*. Thirty-seven years ago, it is recalled by the writer, it took Stanley nine months of travel through the vast equatorial forest of Africa to reach Ujiji and find Livingstone. During almost his entire journey he was lost to communication with the outside world. At 12:30 p. m. on Wednesday, March 29, a cable despatch was sent through the Western Union Telegraph Company from New York to Nairobi, in British East Africa, a station 30 days' march from Livingstone's headquarters; and a reply was received through the Postal Telegraph Cable Company shortly after noon on the following Friday, an interval of less than 50 hours. The cable despatch was transmitted first to the Azore Islands, and thence to Lisbon, Gibraltar, Malta, Alexandria, Port Said, Suez, Aden, Zanzibar and Mombasa, on the East-African coast. Thence it was sent inland to Nairobi by telegraph, and from that point was conveyed 30 miles to the house of the recipient, the total approximate distance being slightly more than 10,000 miles. Owing to the difference in time between New York and Nairobi, the message lost eight hours in transit.

TUNGSTEN LAMP POLICY AT DUBUQUE, IA.—The Union Electric Company, of Dubuque, Ia., under the management of Mr. L. D. Mathes, has begun to introduce tungsten lamps, especially among former users of gas and dissatisfied electric customers. As to maintenance of tungsten lamps, the consumer is given the choice of two plans. By either plan the consumer purchases the initial installation and the company sells the lamp at cost. For maintenance, the company will either renew lamps for 3 cents per kw-hour or the consumer can purchase his lamps as required at the rate of $1.75 each for 100-watt lamps. In the first instance, the company takes the risk and virtually insures the consumer; in the second case the consumer takes the risk. The consumer may change from one plan to the other at any time he may elect. Thus, if a number of lamps burn out at about the same time and the consumer thinks the cost of lamps is running into too much money, the company will figure his meter reading from the time he put in the tungsten lamps, charge him 3 cents per kw-hour, and give him back any amount he has paid for the purchase of lamps in excess of this. On the other hand, if the consumer thinks he can maintain lamps for less than 3 cents per kw-hour, he can change to the plan of renewing them himself. The company expects within a reasonable time, as the tungsten lamp improves in quality, to reduce the flat rate renewal cost. Mr. Mathes reports no difficulty in placing the lamp.

TUNGSTEN LAMP INTRODUCTION AT WABASH, IND.—Mr. T. W. McNamee, manager of the Wabash Water & Light Company, of Wabash, Ind., early in the year began an active campaign with tungsten lamps to improve conditions for dissatisfied customers and to secure customers formerly using gas or gasoline. One of the most notable installations is in the Tremont Hotel, where formerly an installation of common carbon lamps, placed high on old-fashioned chandeliers without suitable reflectors, took 15,400 watts for the lobby and dining room. These were replaced with clusters of tungsten lamps in bowl reflectors hung near the ceiling with lamps pendent, and also a few single tungsten lamps placed at the ceiling, similarly equipped. The tungsten lamp installation takes only 6000 watts, as compared with 15,400, and gives much more satisfactory illumination, making a well-satisfied customer. There are a number of stores in the town which have passed through a number of changes in lighting. To begin with, there were enclosed arc lamps placed in a row down the middle of the store, the store being about 20 ft. wide. These were later replaced by Nernst lamps, but owing to the width of the store and the great distance apart of the Nernst lamps as installed, the illumination between lamps was not satisfactory and a number of such customers yielded to the arguments of the gas company and installed gas arcs. In such stores the plan is to install a two-light chandelier with a very short stem so as to bring the lamps near the ceiling and place on this chandelier two 100-watt tungsten lamps in bowl reflectors for each gas arc. The bowl reflector giving a wide distribution is able to cover satisfactorily a larger area than the Nernst lamps formerly employed. The plan is to put these in on trial, and let the consumer pay for them after he is satisfied that they are what he wants.

The Post Falls Development of the Washington Water Power Company.—I.

By C. S. MacCalla.

TEN miles from the outlet of Lake Cœur d'Alene, on the Spokane River, is the town of Post Falls, Idaho, where is located one of the hydro-electric plants of the Washington Water Power Company. Lake Cœur d'Alene is a body of water some 45 sq. miles in area, situated among the foothills of the Bitter Root Mountains in the western part of Idaho. The lake is 2120 ft. above sea level, and receives the drainage of a large part of the Bitter Root Mountains, being fed principally by the Cœur d'Alene and St. Joe Rivers, and is in turn the source of the Spokane River. In the low-water season there is a fall of about 9 in. between the outlet of the lake and the headwaters at Post Falls, while in flood seasons the difference has been over 8¼ ft., the lake itself having risen over 18 ft. above low-water mark.

Twenty-four miles down the river from Post Falls, in the State of Washington, is the city of Spokane, with 90,000 inhabitants, where is located the head office of the Washington Water Power Company. In the center of the city the Washington Water Power Company owns a series of falls within a distance of 1500 ft., having a total head of 134 ft., 71 of which are at present developed. The company, in addition, owns a modern steam turbine station in Spokane, which is used as an emergency relay and during periods of low water, the plan of the company being to develop its hydraulic plants beyond the limit of extreme low water.

In the design of the Post Falls development two principal objects were sought: (1) The erection of a hydro-electric plant to be operated in parallel with the Spokane hydraulic and steam plants, and (2) the building of a controlling works for the storage of water for use in the low-water seasons, while at the same time permitting a free passage of water during the season of flood water.

The Spokane River at Post Falls has cut through a granite ledge in three separate channels (Fig. 2) affording a head of 50 ft. The North and South Channels were utilized in the construction of controlling works, while the power station was placed directly across the Middle Channel.

Before the commencement of actual development, work was started on the construction of one of the permanent 60,000-volt transmission lines, which was later to be used as a tie line between the Post Falls and Spokane plants. A temporary step-down substation was erected and electric energy furnished from the Spokane station for operating rock crushers, concrete mixers, cableways, cofferdam pumps, as well as for lighting, proving of great value in the elimination of troubles incidental to the operation of numerous small engines and boilers and long lines of steam piping during freezing weather. A telephone circuit erected on the transmission-line poles afforded communication with headquarters in Spokane.

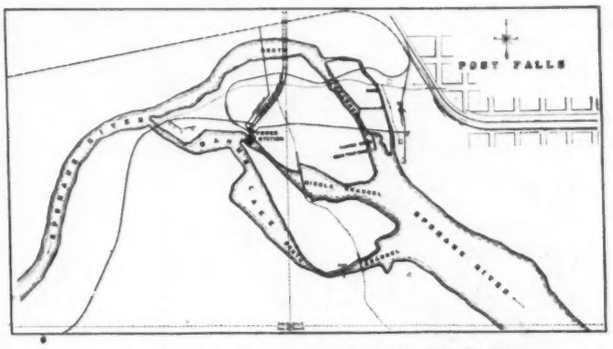


FIG. 2.—MAP OF THE POST FALLS PROPERTY.

CONTROLLING WORKS.

The controlling works permit of a maximum storage of water to a depth of 6½ ft. on Lake Cœur d'Alene, they are also designed to afford a more free discharge of the flood waters than existed in the three channels prior to the construction of the present works. This condition is of value to all ownerships upon Lake Cœur d'Alene and its tributaries, reducing as it does the area of land inundated by the yearly spring freshets, and, on the other hand, holding up the water level in the low-water season, thus aiding the shipping and lumber interests and assuring to Post Falls a navigable channel to the lake.

In the South Channel a concrete dam 78 ft. long was placed, having six gates each 6 ft. wide and 13 ft. high, together with a spillway 42 ft. long. The gates, which are of the ordinary sliding pattern, built of Puget Sound fir, may be raised or lowered by a hand-operated mechanism mounted on a car running on tracks placed on the top of the dam. As these gates would usually be operated only once a year, it was not con-

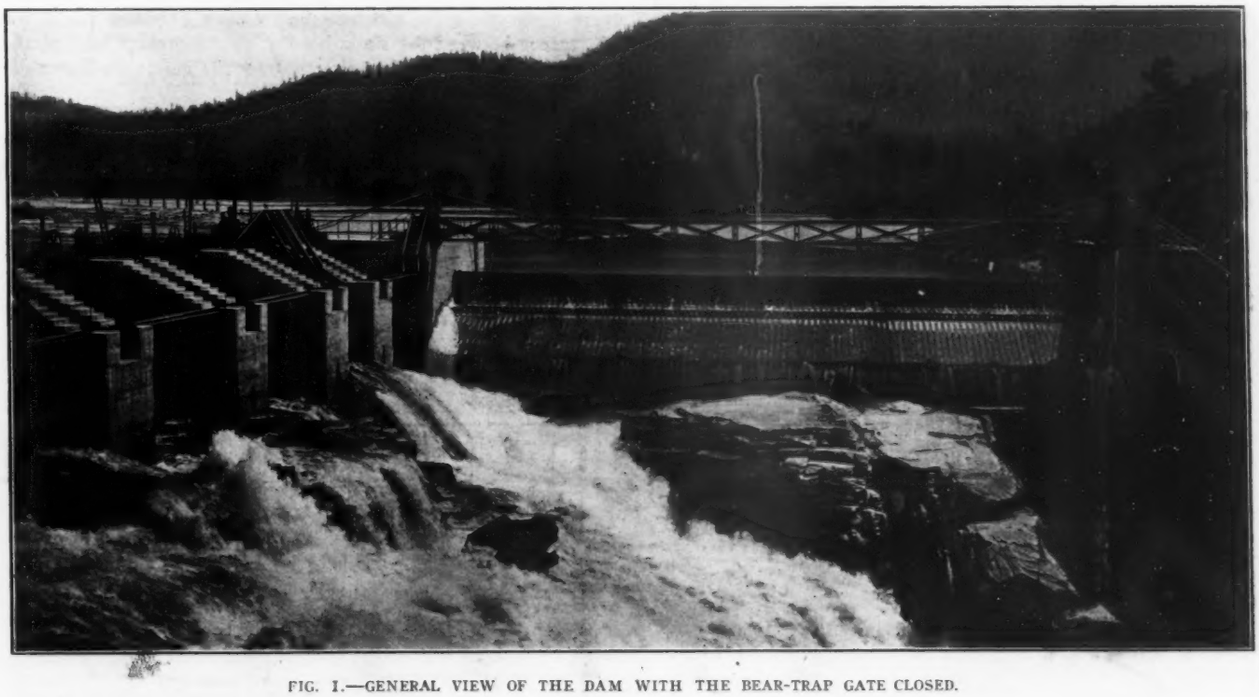


FIG. 1.—GENERAL VIEW OF THE DAM WITH THE BEAR-TRAP GATE CLOSED.

sidered necessary to provide other than a hand-operated device.

In the North Channel are placed the principal controlling works, consisting of seven sluiceways 21 ft. wide, one log sluice 12 ft. wide, each sluiceway controlled by a Tainter gate, together with the main sluiceway, 110 ft. long, controlled by a bear-trap gate of the reversed Parker type.

The Tainter gates are constructed of Puget Sound fir, with cast-iron hinges fitted to steel hinge beams of I-beam construc-

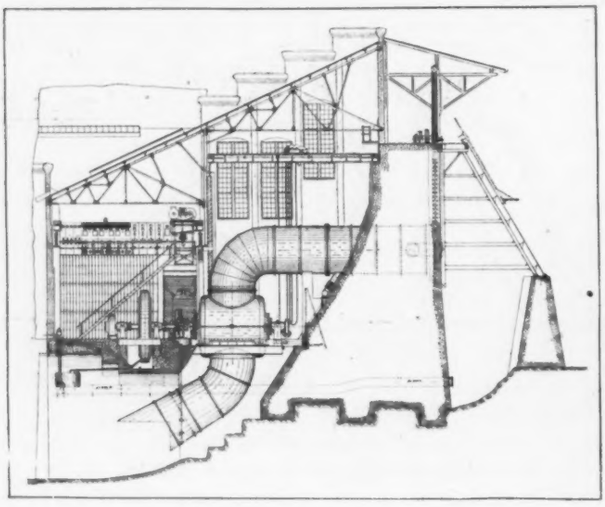


FIG. 3.—TRANSVERSE SECTION OF POST FALLS STATION.

tion embedded in concrete piers. The hinge beams are anchored with long steel rods and anchor castings distributing the pressure to the base of the piers near the up-stream faces. Each gate is counter-weighted by a concrete cylinder weighing 4.8 tons, and is easily operated by one man by means of a worm-gear mechanism carried on I-beams placed across the sluiceway on the top of the piers.

The bear-trap gate consists of four leaves, having two fixed and two movable hinges, the X or resisting leaf, the Y or lifting leaf, the Z or connecting leaf, and the idler leaf, the function of the latter being to protect the connecting leaf and hinges.

The gate is placed partly on natural rock; where the latter was at too low an elevation a foundation was built up with a cyclopean rubble concrete substructure. The base timbers were securely bolted to the natural rock or substructure, the space between the base timbers and the natural rock or substructure being filled with concrete and a water-tight connection thereby made. Extreme care was exercised in accurately locating the piers with their faces perpendicular and at right-angles to the line of the dam, the faces of the piers adjoining the gate being absolutely parallel.

The material used in the gate was Puget Sound fir for the base timbers and leaves, cast-iron in the hinges, with steel hinge pins.

The gate is operated hydraulically from the adjoining concrete piers. For this purpose, tunnels are built in each pier, connecting the space under the gate with both head and tail water. A rack is placed at each opening to the headwater to prevent bark, rubbish, etc., getting under the gate. Two valves of the Tainter type control the tunnels in each pier. A crab placed on top of the pier operates both valves. To raise the gate the down-stream valve in each pier is closed and the up-stream valve in either or both piers opened. This exerts a lifting pressure under the gate, which is the resultant pressure due to the difference between the static head at the up-stream inlet of the piers and the head acting directly over the gate. To lower the gate, both up-stream valves are closed, and one or both down-stream valves opened.

FIG. 5.—VIEW OF THE POWER STATION FROM THE DOWN STREAM SIDE.

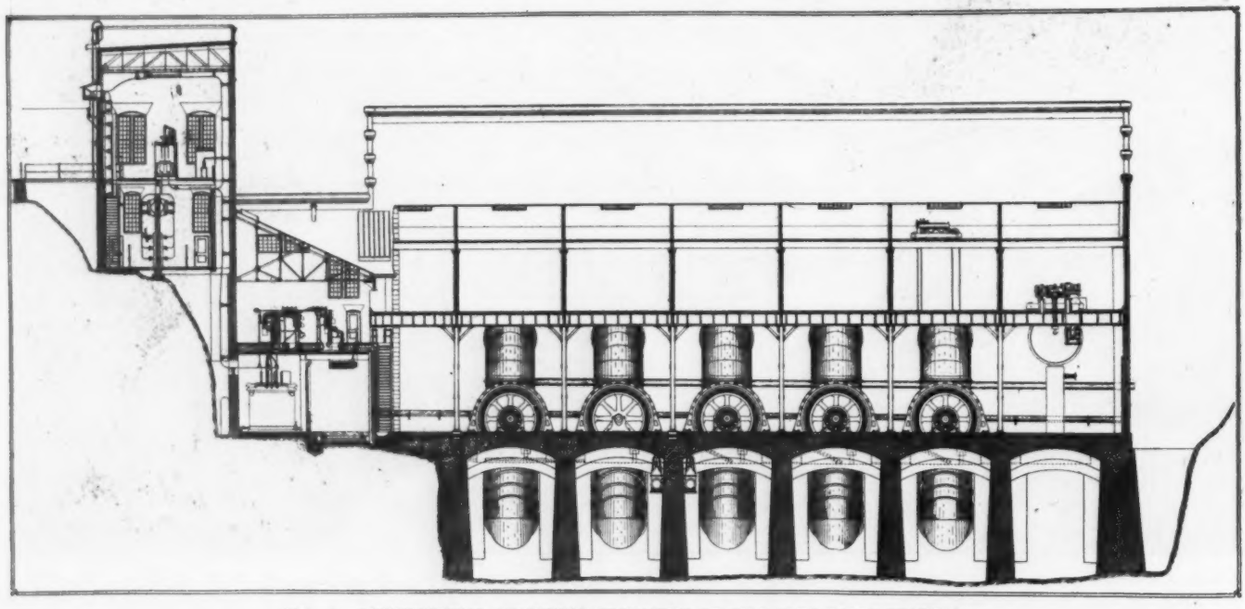


FIG. 4.—LONGITUDINAL SECTIONAL ELEVATION OF THE POST FALLS STATION.

POWER HOUSE AND DAM.

In the Middle Channel a solid concrete dam was erected across the channel, forming the up-stream wall of the power house. (Fig. 3.)

The work of concreting was prosecuted vigorously night and day during the entire winter. To this end a steam boiler was

used, and hot water was furnished for mixing the concrete. The crushed rock was heated by a pipe furnishing steam in the bottom of the rock bin.

The concrete was taken from the mixing plant in buckets placed on flat cars operating on a short track extending under three cableways stretched across the work. The amount of water used in mixing was so regulated that the men in tamping would sink almost to their ankles in the wet mixture.

After concreting was completed in any part of the work, that part was covered loosely with canvas under which steam from a hose was kept playing until the concrete had sufficiently set.

In excavating for the power house the larger uncracked granite boulders which could not be used directly in the rock crusher were piled conveniently on one side under the cableways and later, after being thoroughly cleaned and wetted, re-

A complete cement testing laboratory was maintained on the work and full tensile (seven days and 28 days, hot and cold water) and pat (air, cold and hot water) tests carried out. Six samples were taken from every carload (averaging 150 bbl. each), and additional samples when the first test appeared unsatisfactory.

The up-stream face of the dam was waterproofed by applying alternately two coats of solutions of soft soap and alum, respectively. Great care was exercised in grouting crevices and placing the concrete at either end of the dam against the rock walls or abutments. The result has shown an exceptionally water-tight job, an essential condition as the dam forms a wall for the generator and turbine room.

The three cableways which were used for rock excavation and concreting were also used in placing the sections of the in-

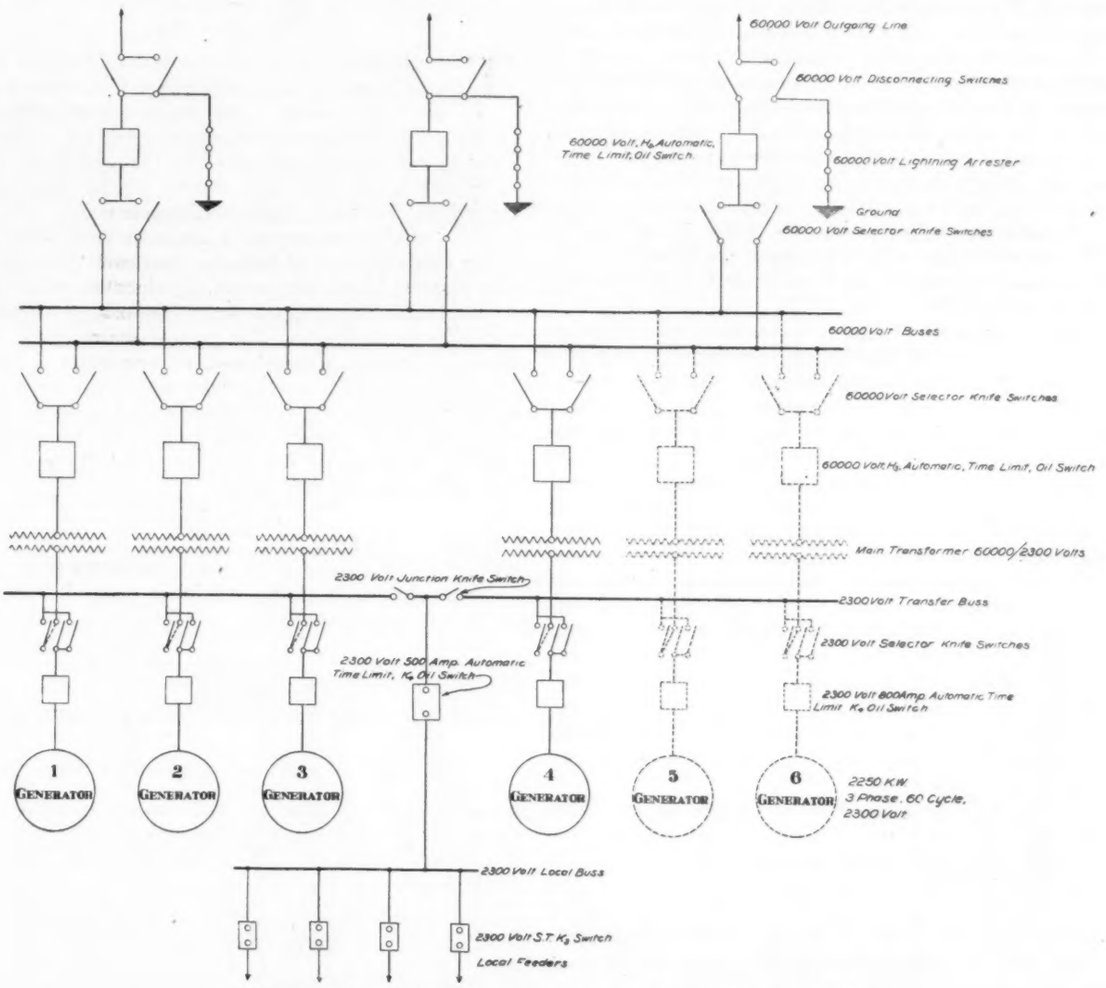

60000 Volt Outgoing Line
60000 Volt Disconnecting Switches
60000 Volt, K6 Automatic, Time Limit, Oil Switch
60000 Volt Lightning Arrester
Ground
60000 Volt Selector Knife Switches
60000 Volt Buses
60000 Volt Selector Knife Switches
60000 Volt K6 Automatic, Time Limit, Oil Switch
Main Transformer 60000/2300 Volts
2300 Volt Junction Knife Switch
2300 Volt Transfer Buss
2300 Volt Selector Knife Switches
2300 Volt 500 Amp. Automatic Time Limit, K6 Oil Switch
2300 Volt 800 Amp. Automatic Time Limit K6 Oil Switch
1 GENERATOR
2 GENERATOR
3 GENERATOR
4 GENERATOR
5 GENERATOR
6 GENERATOR
2250 KW 3 Phase, 60 Cycle, 2300 Volt
2300 Volt Local Buss
2300 Volt S.T. K6 Switch
Local Feeders

FIG. 6.—WIRING DIAGRAM WITH EQUIPMENT IN THE POST FALLS STATION.

placed in the concrete, the latter being carefully tamped around them. The boulders were placed not less than 6 in. from each other or from the faces of the dam.

Before commencing the concreting, the foundation of granite bedrock was carefully cleaned and covered with a grouting of neat cement. In freezing weather steam was used to thoroughly free the bedrock of frost and ice.

The concrete was carried across in layers. The large boulders were left projecting above the surface of each layer to form a dowel for the layer next above.

No special provision was made for expansion and contraction, the resulting strain being taken up in the mass of concrete. No cracks have become visible in the more than a year's time since the full hydraulic pressure has been against the dam.

The concrete was in the proportion of one part Portland cement, three parts clean sharp sand and six parts of crushed rock, run of crusher up to and including 2-in. size.

take pipe in the dam, as well as erecting the structural steel for the crane columns, girders and roof trusses.

Figs. 4 and 3 show, respectively, the longitudinal and transverse sectional elevation of the plant, giving clearly the relative arrangement of the machinery, switchboard, etc.

The headgates are of the sliding pattern, of steel and timber construction, and are operated by a motor-driven mechanism placed on the top of the dam. This consists of a 15-hp motor direct-connected to the operating shaft extending across the dam. Opposite each gate a hand-operated clutch connects the shaft to a quill and this moves, through a worm-gear and pinions, the racks placed on the gate stems. At the side of each gate is a filler gate 36 in. in diameter, with a pipe connection to the main feeder pipe. The filler gates are operated from the main shaft on the dam in a similar manner to the main gates. The entire mechanism is so designed that the gates may be operated, one at a time, at any stage of water. The purpose

of the filler gate is to facilitate the raising of the main headgate by filling the feeder pipe or penstock with water from the forebay, thus tending to equalize the hydraulic pressure on both sides of the headgate.

Racks extend the entire length of the dam, at one end of which is a small spillway used in sluicing rubbish, bark, etc. The racks consist of iron bars ⅜ in. x 2 in. placed on edge, 1⅜ in. in the clear between bars, and supported by a steel I-beam construction extending from the face of the dam and resting on a concrete footing placed on the solid rock. The velocity of the water flowing through the racks will not exceed 2¼ ft. per second when the plant is carrying full load, or 18,000 hp, and with the water level in the forebay at the low-water stage.

In order to install the quarter-turn leading to the turbine it was necessary to place the intake pipes rather closer to the extreme low-water level than ordinary practice would deem desirable. In order to prevent the formation of whirlpools and the introduction of air into the feeder pipes, a raft of baffle boards was placed in front of each headgate. Each raft is 17 ft. long by 12 ft. wide, and consists of 1 in. by 12 in. boards placed on edge and spaced 3 in. in the clear between boards. These proved their efficacy during the first summer the plant was in operation, when, on account of the unfinished condition of the North Channel controlling works, the water in the forebay reached a level of only 2 ft. 5 in. above the entrance to the feeder pipes, and the vacuum gages on the draft tubes continued to show normal vacuum.

The power station, other than the wall made by the dam, is built of brick, on concrete foundations over the tail-race and on original rock in the rest of the building. The plant may be considered as being divided into three parts, namely: (1) the turbine and generator room; (2) the transformer and low-tension switchboard-rooms, and (3) the high-tension switch and bus rooms. The station is designed for six 2250-kw generating units, six 2200-kw step-up transformers, three 60,000-volt outgoing lines, one 22,500-volt and four 2300-volt feeders, each outgoing line and feeder being equipped with lightning arresters. The first three generator and transformer units have been in operation since the summer of 1906. The fourth unit is now in service, and fifth will be in operation early in the summer of 1908.

The turbine and generator room is 175 ft. long by 61 ft. wide. The units, which are direct-connected, are spaced 25 ft. on centers (Fig. 4). A track connecting with the Northern Pacific Railroad enters the building at one end so that cars may be unloaded by either or both cranes.

A line of steel lattice columns extends across the room between the generators and water-wheels. These columns, besides supporting the roof trusses, carry one rail of each of the two Niles cranes—a 10-ton hand crane over the turbines and a 30-ton electric crane over the generators. The other rail of these cranes is carried, respectively, the one on a notch built in the dam, and the other on plate girders supported on brick pilasters along the down-stream wall of the building.

Large windows are placed in the down-stream and end walls, as well as in the brick wall built on the top of the dam, giving a well-lighted room and providing excellent ventilation.

The roof consists of steel trusses securely anchored to the brick wall on top of the dam and supported in addition by the steel columns and down-stream brick wall. The columns are placed on lead plates ⅛ in. thick and securely anchored to the concrete foundations. The roof trusses are covered with 2-in. x 12-in. sheathing, which is waterproofed by Carey's magnesia roofing.

The transformer room forms an L at the end of the turbine and generator room, and is laid out for six 2200-kw, three-phase transformers. Under normal conditions each generator and its transformer together are operated as a unit. A switching arrangement and transfer bus permits any generator being operated with any transformer.

On the floor above the transformers and forming a gallery at one end of the generator room, is placed the controlling switchboard (Fig. 4). This is arranged in the form of a combined bench and panel board of blue Vermont marble. The diagram of the main wiring connections is shown in Fig. 6. In Fig. 4 is shown in section the electrical connections between generators, switchboard, transformers and the 60,000-volt switches and buses. Dummy buses with indicating lamps and switches are mounted on the panels and bench board so that the operator has before him at all times a clear diagram of the connections.

Inductance of Electric Transmission Lines with Unsymmetrically Disposed Conductors.

By Alfred Still.

THE object of this article is to indicate a simple method of calculating the total induced e.m.f. in any conductor of an electric-energy transmission system, whatever may be the actual arrangement or relative positions of the conductors. It is assumed in all cases that the conductors are of circular section and that they remain parallel with each other throughout the whole distance of transmission.

FLUX SURROUNDING A STRAIGHT CONDUCTOR.

The magnetic lines of induction surrounding a long straight wire carrying an electric current, of which the return path is at a considerable distance, will be in the form of circles concentric with the conductor. The path of the magnetic lines will, therefore, increase in length in direct proportion to the distance from the conductor; and the intensity of the magnetic field—usually denoted by the letter **H**—will vary inversely as the distance (from the center of the conductor) of the point considered. This relation was first experimentally proved by Biot and Savart, the formula being:

$$\mathbf{H} = \frac{2I}{l} \qquad (1)$$

where l is the distance of the point considered from the center of the conductor, all quantities being in c.g.s units. In order to

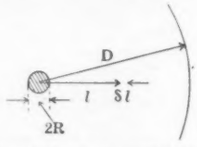


FIG. 1.—FORCES AROUND A STRAIGHT CONDUCTOR.

calculate the total flux of self-induction surrounding unit length (1 cm) of straight conductor, carrying a current I, up to a limiting distance of D cms, when the diameter of the conductor is $2R$ (see Fig. 1) we have

$$\mathbf{N} = \int_{R}^{D} \frac{2I}{l}\, dl$$
$$= 2I\,(\log_e D - \log_e K)$$
$$= 2I \log_e \frac{D}{R} \qquad (2)$$

EFFECT OF TAKING INTO ACCOUNT THE RETURN CONDUCTOR.

There would be no limit to the self-induction of a long straight conductor if the effect of the return current could be entirely neglected, and the actual effective flux surrounding any single conductor of a transmission system will depend upon the distance of the parallel return conductor or conductors.

Consider, first, the loop formed by two parallel conductors of circular cross-section, one carrying the outgoing current I and the other carrying the return current $-I$ (see Fig. 2). The flux due to the current I in the conductor A may be considered as extending indefinitely throughout space, with ever-weakening intensity as the distance from the conductor increases, and the same argument applies to the flux surrounding the return conductor B, the only difference being that, if the direction of the

flux round A be considered positive, that which surrounds B will be in a negative direction. It follows that the whole of the magnetic flux due to the current I in A, which is situated at a distance greater than the distance D between centers of the outgoing and return conductors, is exactly neutralized by the flux due to the current $-I$ in B. Thus, in Fig. 2, it will be seen that

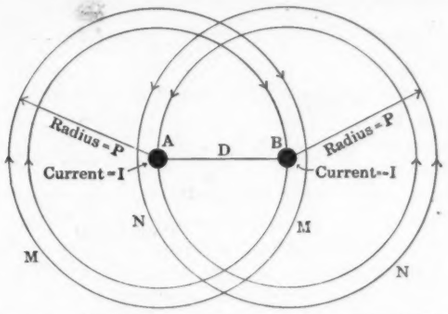


FIG. 2.—FORCES AROUND TWO PARALLEL CONDUCTORS.

the flux of induction surrounding A up to a distance D, is not neutralized by the current $-I$ in the conductor B; but any magnetic line, such as M, situated at a greater distance, P, from the center of the conductor A, is exactly neutralized by the magnetic line N, due to the return current in conductor B, since it also surrounds the conductor A, but in an opposite direction to the line M. It follows that the total *effective flux* surrounding A—that is, the resultant flux which will give rise to an induced e.m.f. in the conductor when carrying an alternating current—is merely that portion of the total self-produced flux included between the surface of the conductor[1] and the surface of an imaginary cylinder, concentric with the conductor, and of radius D, equal to the distance between the centers of the outgoing and return conductors. The formula (2) can, therefore, be used for calculating the flux which is effective in producing an e.m.f. of self-induction in a straight conductor when the whole of the return current is situated at a distance D from the center of the conductor.[2]

CALCULATION OF THE TOTAL FLUX WHEN THERE ARE SEVERAL RETURN CONDUCTORS.

In Fig. 3 the total outgoing current I is supposed to flow along one conductor, while the total return current is divided up between a number of conductors, the condition being that

$$I = -(I_1 + I_2 + I_3 \ldots\ldots + I_n)$$

Let D_1, D_2, D_3, etc., represent the distances between centers of the corresponding conductors carrying the return currents and

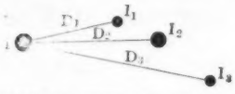


FIG. 3.—COMMON OUTGOING CURRENT PATH AND DIVIDED RETURN PATH.

the conductor carrying the outgoing current, and note that the total flux surrounding the latter conductor may be considered as the algebraic sum of several separate fluxes, namely: the flux due to a current I_1 returning at a distance D_1, the flux due to a current I_2 returning at a distance D_2, and so on, for any number of components of the total current I. All these separate components of the total flux can readily be calculated by means of formula (2), and the expression for the total flux due to the current I returning along a number of separate conductors, as indicated in Fig. 3, becomes:

$$\mathbf{N} = 2 \times \left[-I_1 \log_e \frac{D_1}{R} - I_2 \log_e \frac{D_2}{R} - \ldots\ldots I_n \log_e \frac{D_n}{R} \right] \qquad (3)$$

PRACTICAL APPLICATION—POLYPHASE TRANSMISSION.

In the case of energy transmission by polyphase currents, with any number of conductors, the algebraic sum of the currents in the conductors must, at any given instant, be equal to zero. Any one conductor can be looked upon as carrying the outgoing current, while the remaining conductors together carry the return current. Formula (3) can, therefore, be used for calculating the effective flux of induction surrounding any one conductor in a polyphase transmission, whatever may be the arrangement of the conductors. The phase relations of the various component fluxes must, however, be taken into account, and for this reason the graphical addition of vector quantities with the help of a diagram will be found most convenient. Instead of drawing the vectors representing magnetic flux components—in phase with the current vectors—the component vectors of the resultant e.m.f. of self-induction may be drawn—in this case 90 time-degrees behind the corresponding current vectors.

In order to calculate the induced e.m.f. it will be advisable first to put equation (3) in a more practical form. The symbols I_1, I_2, etc., in equation (3), when the latter is to be used for calculating the maximum value of the induction due to an alternating current, must be considered as representing the maximum value of the current wave expressed in absolute c.g.s. units. But since

$$\text{C.g.s. unit of current} = \frac{\text{amperes}}{10}$$

$$\left.\begin{array}{l}\text{maximum value of current on}\\ \text{the assumption of sine curve}\\ \text{wave form}\end{array}\right\} = \sqrt{2} \times \sqrt{\text{mean square}}\text{ value.}$$

Hyperbolic logs = common logs × 2.3026, the multiplier in front of the brackets in formula (3) becomes.

$$\frac{2 \times \sqrt{2} \times 2.3026}{10} = .6512$$

and if $\mathbf{N}$ is to represent the total flux per mile of conductor instead of per centimeter:

$$\mathbf{N} = 10480 \times \left[-I_1 \log_{10} \frac{D_1}{R} - I_2 \log_{10} \frac{D_2}{R} \ldots\ldots - I_n \log_{10} \frac{D_n}{R} \right] \qquad (4)$$

where the currents I_1, I_2, etc., in the various conductors are the amperes as indicated by an ammeter. In calculating the induced e.m.f. it must be remembered that the total effective number of magnetic lines surrounding the conductor are twice created and twice destroyed during one complete period. It follows that if $\mathbf{N}$ is the maximum value of the flux and f the frequency, the mean value of the induced volts will be

$$e_m = \frac{4\mathbf{N}f}{10^8}$$

and if we assume the sine wave form giving $\sqrt{\text{mean square}}\ \text{value} = \frac{\pi}{2\sqrt{2}}\ \text{mean value}$, we have:

$$\text{Induced volts} = e = \frac{2\pi \mathbf{N} f}{\sqrt{2} \times 10^8} \qquad (5)$$

Inserting for $\mathbf{N}$ the value as given by formula (4) there is obtained for the induced volts per mile of conductor:

$$e = .004655 \times f \times \left[-I_1 \log \frac{D_1}{R} - I_2 \log \frac{D_2}{R} \ldots - I_n \log \frac{D_n}{R} \right] \qquad (6)$$

NUMERICAL EXAMPLE.

Consider a three-wire, two-phase overhead transmission system with the conductors occupying the vertices of an equilateral

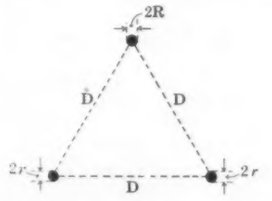


FIG. 4.—SYMMETRICAL ARRANGEMENT OF THREE CONDUCTORS.

triangle (see Fig. 4). If the load is balanced, the current I_1 in No. 1 conductor will be equal to I_2 in No. 2 conductor, but the current in the common return conductor, No. 3, will be $\sqrt{2}$ times I_1 or I_2.

[1] The induction *within* the material of the conductor has been disregarded throughout the whole of this article.

[2] The intensity of the magnetic field at any point outside a long, straight cylindrical conductor can always be calculated on the assumption that the whole of the current is concentrated along the axis of the conductor.

Let I_1 and $I_2 = 50$ amperes.

$I_3 = 70.7$ amperes.

Distance between conductors D = 18 in.

Diameter of No. 1 and No. 2 conductors $= 2r = \frac{3}{8}$ in.

Diameter of No. 3 conductor $= 2R = \frac{1}{2}$ in.

Considering, now, the quantity between brackets in formula (6); it will be noted that, on account of the symmetrical arrangement of the conductors, the whole of the return current

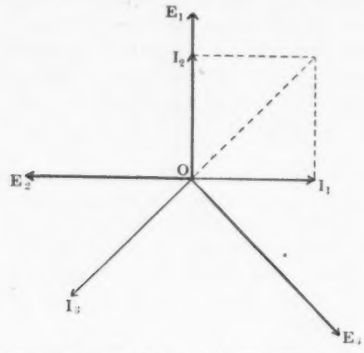


FIG. 5.—CURRENTS AND E.M.F'S. WITH SYMMETRICAL ARRANGEMENT.

is at a distance D (= 18 in.) from any one of the conductors considered as carrying the outgoing current. The quantity between brackets will, therefore, be

$I_1 \log \frac{D}{r}$ for calculating the flux round conductor No. 1.

$I_2 \log \frac{D}{r}$ for calculating the flux round conductor No. 2.

$I_3 \log \frac{D}{R}$ for calculating the flux round conductor No. 3.

The induced volts per mile, at full load, in the conductors, respectively, as calculated by formula (6) will be

In No. 1 and No. 2 conductors, 9.8 volts.

In No. 3 conductor, 12.80 volts.

The vectors representing these quantitites have been drawn in Fig. 5; each pressure vector being drawn to scale exactly 90 time-degrees behind the corresponding current vector.

The conditions are not so simple when the conductors are arranged as in Fig. 6, this arrangement being such that the distance between conductors 1 and 2 is greater than the distance separating either of these from the common return, in exact

FIG. 6.—UNSYMMETRICAL ARRANGEMENT OF THREE CONDUCTORS.

proportion to the difference of potential as measured between the conductors.

The quantity between brackets in formula (6), as applied to conductor No. 1, now becomes:

$$\left[-I_2 \log \frac{D\sqrt{2}}{r} - I_3 \log \frac{D}{r}\right]$$

$$= \left[-I_2 \log \frac{D}{r} - I_2 \log \sqrt{2} - I_3 \log \frac{D}{r}\right]$$

$$= \left[I_1 \log \frac{D}{r} - I_2 \log \sqrt{2}\right] \qquad (7)$$

this last simplification being obtained by inserting for $-(I_2 + I_3)$ its equivalent value I_1.

In a similar way, it will be found that the quantity in brackets in formula (6), as applied to conductor No. 2, becomes

$$\left[I_2 \log \frac{D}{r} - I_1 \log \sqrt{2}\right] \qquad (8)$$

while for conductor No. 3 (the common return) the condition is as before, seeing that the whole of the return current $(I_1 + I_2)$ is at the same distance $(D = 18$ in.) as assumed in working out the previous example.

The vector diagram has been drawn in Fig. 7, and the numerical values of the component induced e.m.fs. work out as follows:

For conductor No. 3, $OE_3 = 12.8$ volts, as before.

For conductor No. 1 $OF = .004655 \times f \times I_1 \log \frac{D}{r}$

$= 9.8$ volts, and,

$OG = .004655 \times f \times I_2 \log \sqrt{2} = .87$ volts.

For conductor No. 2.

$OK = 9.8$ volts and $OH = .87$ volts,

the resultant vectors representing the total induced volts in conductors 1 and 2, being OE_1 and OE_2, respectively.

It will be seen that, although the components OF and OK are drawn 90 time-degrees behind the corresponding current vectors, the smaller components, OG and OH—which owe their existence to the unsymmetrical arrangement of the conductors—have been drawn in time-advance of the current vectors OI_2 and OI_1. This is because of the negative sign before the last item in the expressions (7) and (8).

It is interesting to note that the particular component of the total induced e.m.f., represented by the vectors OG and OH, is exactly in time-phase with the current I_1, and exactly opposite in time-phase to the current I_2. This results in the total induced

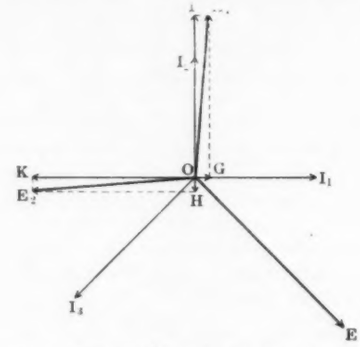


FIG. 7.—CURRENTS AND E.M.F'S. WITH UNSYMMETRICAL ARRANGEMENT.

e.m.f. lagging less than a quarter period behind the leading current (in this example, I_1) and more than a quarter period behind the lagging current (I_2). This is clearly shown in the vector diagram.

Parallel Operation of Alternators.

By Henry Herman.

In view of the letters from Mr. Waldo V. Lyon and Mr. Milan V. Ayres in your issues for Jan. 25 and Feb. 15, respectively, relating to the parallel operation of alternators, it is believed that the following explanation of the facts mentioned by you in the former issue and verified by Mr. Ayres in the letter, may prove of interest to your readers.

It has frequently been observed that a synchronous machine with normal impressed e.m.f. and zero field current may keep in step and consume considerable power, either electrical or mechanical. This result is attributable solely to the influence of the periodical variation of the coefficient of self-induction, or, what is the same, to the effect brought about by the periodical variation of the reactance of the armature circuit.

As an approximation, one may assume that the coefficient of self-induction in an alternator varies, as shown in Fig. 1; that is, it may be represented by a sine wave of twice the frequency of that of the main current.

In Fig. 1 let L be that portion of the coefficient of self-induction which is constant in value, λL, be the amplitude of the variation. The instantaneous values are then:

$$l = L\,(1 + \lambda \cos 2\beta)$$

β being a time-angle having the value indicated. Thus, the

coefficient of self-induction consists of two components. The component L is constant in value, and corresponding to the constant part of the reactance X_1, and $\lambda \cos 2\beta$ is variable in magnitude and equivalent to the variable portion of the reactance, which latter again consists of two components, X_2 and X_3, as will be shown below.

If now an alternator is deprived of its field current, its counter e.m.f (or e.m.f. due to the mechanical rotation of the field flux) is reduced to zero, or nearly so. The only e.m.f.

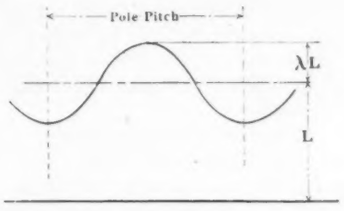


FIG. 1.—FLUCTUATING SPACE VALUE OF SELF-INDUCTION COEFFICIENT.

induced in the armature winding is that of self-induction; that is, the e.m.f. due to the flux set up by the armature currents. This flux is of a pulsating character in a single-phase alternator and revolves synchronously in a polyphase machine. As a rule, the e.m.f. of self-induction is not wattless, but contains a power component, the latter representing either consumption or production of electrical power according to the phase relation between the current wave and the reactance wave.

To illustrate the above more clearly one may proceed as follows: The total flux set up by the armature currents may be resolved into three components. First, ϕ_1 a component which does not cross the air-gap and which is interlinked with the armature conductors. This flux, in time-phase with the total current, may be called the flux of self-induction proper;

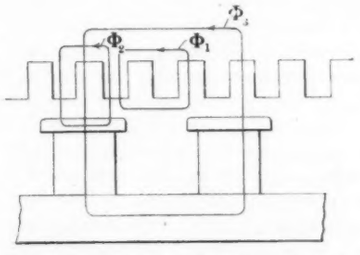


FIG. 2.—PATHS OF REACTANCE FLUXES.

it produces an e.m.f. E_{s1}, lagging 90 time-degrees behind I. Second, ϕ a component which crosses the gap twice and which may be considered as being in time-phase with the watt component I_e of the current. This flux under normal operating conditions distorts the main field but does not contribute to the magnetization or demagnetization of the main field; E_{s2} the e.m.f. due to ϕ_2 lags 90 time-degrees behind I_e. Third, ϕ_3 the flux which crosses the gap twice and which is interlinked with the field winding. Flux ϕ_3 magnetizes the field poles, the direction and magnitude of the magnetization depending upon the time-phase relation between the current wave and the reactance wave. Being in time-phase with I_m, the wattless component of the current, ϕ_3, produces an e.m.f. E_{s3} lagging 90 time-degrees behind I_m.

The vector diagrams of Figs. 3 and 4 show the conditions prevailing in a synchronous alternator with constant impressed e.m.f. and zero field excitation. In these diagrams, which are not drawn to scale, the current I has been resolved into its components I_e and I_m, with reference to the variation of the reactance.

Generally speaking, the direction of E_{s3} is that of E_0, the e.m.f. which would be induced in the alternator when running with normal field m.m.f.

In Figs. 3 and 4 let

I = total current.

I_e = component of I in time-phase with the internal e.m.f.

I_m = component of current I in time-quadrature with the internal e.m.f.

E = constant impressed e.m.f.

I_r = e.m.f. consumed by effective resistance of armature.

E_{s1} = e.m.f. consumed by reactance due to flux ϕ_1.

E_{s2} = e.m.f. consumed by reactance due to flux ϕ_2.

E_{s3} = e.m.f. consumed by reactance due to flux ϕ_3.

Θ = time-phase displacement between current I and impressed *e.m.f.* E.

E'_{s2} = projection of E_{s2} upon I.

E'_{s3} = projection of E_{s3} upon I.

Again, let

a = number of phases, and T = torque of alternator, in "synchronous watts."

From Figs. 3 and 4:

$$T = a\, I\, E \cos \Theta$$

$$T = a\, I\, [E'_{s3} - (E'_{s2} + Ir)]$$

In this equation the product aI (Ir) represents the power consumed by the copper loss; thus this quantity can neither reappear as electrical power in the line in the case of a generator, nor as mechanical power at the shaft when the alternator is operating as a synchronous motor. Hence the useful internal torque; that is, the torque representing the available power will

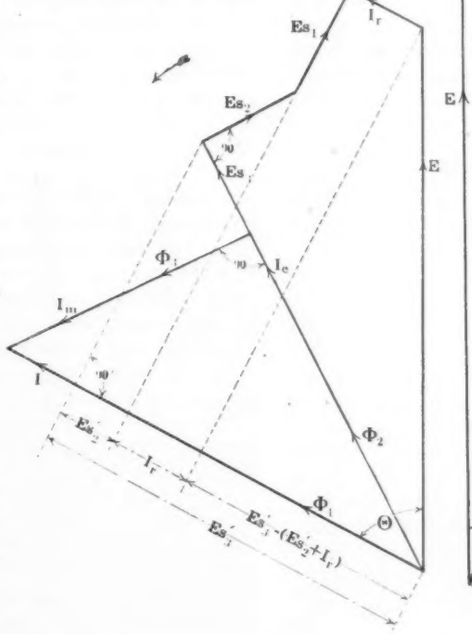


FIG. 3.—TIME-PHASE RELATION OF CURRENTS AND E.M.F'S. IN A SYNCHRONOUS MOTOR.

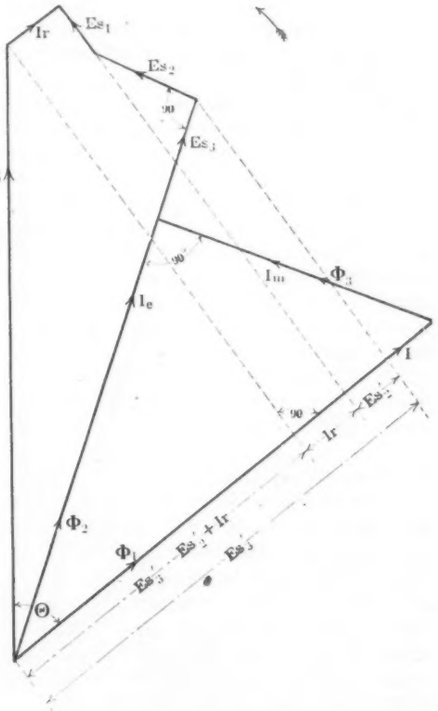


FIG. 4.—TIME-PHASE RELATIONS OF CURRENTS AND E.M.F'S. IN A SYNCHRONOUS GENERATOR.

be reduced to zero when $E'_{s3} - E'_{s2} = 0$; in other words, when $E'_{s3} = E'_{s2}$.

Assuming proportionality between the m.m.f. and the magnetization, which seems permissible, one may write: $E_{s2} = I_e X_2$; $E_{s3} = I_m X_3$. That is, for a certain current and time-phase displacement E_{s2} is proportional to X_2, and E_{s3} is proportional to X_3. With constant impressed e.m.f. and zero field excitation, the torque of the alternator vanishes only when the reactance of the component of the current in time-

phase with the internal e.m.f. is equal to that of the component in time-quadrature therewith, a condition never met with in modern alternators of large size.

As will be seen from Fig. 4, the alternator without field excitation can act as a generator only when the current demanded by the line contains a large leading component.

In summing up, then, one may state that if an alternator with constant impressed e.m.f. loses its field excitation entirely, it may drop the load and fall out of step. In the majority of cases, however, the torque of the machine does not disappear, and if conditions are favorable the alternator will carry considerable load, although there will be large wattless currents. For a given phase displacement the torque of the alternator will be the greater the greater the difference between the reluctances of the main path of the field magnetism and of the electrical space-quadrature path of the magnetism produced by the armature m.m.f.

Convention of the National Electric Light Association.

The annual convention of the National Electric Light Association was opened at the Auditorium Hotel, Chicago, Tuesday of this week, and was still in session at the time of going to press. Following are abstracts of papers scheduled to be read at the various sessions, which extend over Tuesday, Wednesday, Thursday and Friday.

REPORT ON PROGRESS.

The report of the Committee on Progress, Mr. T. C. Martin, chairman, occupied 58 pages and was devoted as usual to a review of the events and developments of the year. It showed that for the first time in its history the association has over 5000 central station systems to draw upon for membership. The statistics of American growth were compared with those of Germany, France and England, and data were given as to conditions in Paris and London. A large section discussed the subjects of rates, franchises and methods of State regulation, giving recent rulings and decisions, and recent methods adopted by member companies. Newer central station work was dealt with next, particularly the plant at Ellicott City, Md., enclosed within the dam itself; the 100,000-volt Grand Rapids-Muskegon line, and the oil burning plant at Pittsfield, Mass. Special street lighting effects were next taken up, as exemplified at Denver, New York, Pittsburg and Chicago, and billboard lighting methods were described. This was followed by data on the lighting of the Marshall Field store in Chicago. The section on lamps was prefaced by data as to illuminating engineering, government specifications for lamps and meter testing in various places. Under the topic head of relations with employees, the educational methods of the New York and Brooklyn Edison Companies were briefly described, and the Scranton agreement with the men, as well as the new "service supervisors" in Denver. Mr. Martin then devoted considerable space to the new metallic filament lamps and the newer forms of arcs, citing results reported from many cities. New mercury-vapor lamps were also noted. Electric heating and motor data and developments were then summarized, and the closing section of the report dealt with relations with the public, including such matters as exhibitions, prepayment meters, show windows, free wiring, etc.

GAS ENGINES.

The committee on gas engines, consisting of Mr. Wm. C. L. Eglin, chairman, and Messrs. J. E. Klumpp and I. E. Moultrop, presented a 172-page report dealing with the more important points concerning the design features and operating characteristics of modern gas engines and producer plants. Although the committee was unable to present any definite figures as to efficiencies, it stated that the efficiency of a combined gas engine and producer is higher than that of a combined plant of steam boiler and engine, and the former must command the attention of all companies using fuel for producing electrical energy. The mechanical features of gas engines have been so simplified that continuous operation can be expected with no more attention than that given to steam engines of equal rating. Gas engines are now being operated in nearly every field occupied by the steam engine. The committee stated its belief that gas engines will be used with increasing satisfaction in central station work. Gas producers have not reached the stage of development attained by the gas engine. Before the gas-engine generating station can be generally accepted and be compared with the steam-engine equipment, there must be developed a type of producer utilizing successfully the cheapest and poorest forms of commercial fuel. At the present time the cost of gas engines is much in excess of that of steam engines for the same output. However, it seems possible to build a combined producer and gas-engine equipment for costs approximately that of the combined steam-boiler and engine plant, when all auxiliary and buildings are included.

LIGHTING OF LARGE INTERIORS.

In a paper entitled "Illuminating Engineering" Mr. W. D'A. Ryan discussed the various methods of illuminating interiors that are now in use. He expressed the opinion that as time advances concealed and semi-concealed methods of lighting as applied to large interiors will become more general, and the painful exposed high-intrinsic-brilliancy sources of light, so common to-day, must necessarily vanish as the public becomes educated to higher standards of illumination. As an example of the cases where for architectural, or other, reasons it is desirable to light large spaces by totally concealed sources, mention was made of the arrangements for illuminating the waiting-room of the new Union Station at Washington, D. C., by means of inverted arc lamps. The arc between the carbon electrodes of the lamp is arranged to form above the mechanism, and in this particular case the lower electrode is positive. The reflector is adjustable so that the light can be turned to the proper place on the ceiling or side walls, and a diffusing screen covers the arcs so as to eliminate strong contrasts. Notwithstanding the large cubical contents of the waiting-room and the fact that the lamp arrangement is of the totally-concealed class, the efficiency is remarkably high and compares favorably with exposed sources, due to the fact that the excessive intrinsic brilliancy of such sources is entirely eliminated by the system and the eye is permitted to adjust itself properly for the general illumination.

In one of the Lynn factories of the General Electric Company a practical test is being conducted to determine the cost and relative merits of various lighting systems suitable for illuminating the erecting bay containing 4200 sq. ft. of floor area. The lighting units represented include series and multiple tungsten, tantalum and carbon incandescents, alternating- and direct-current enclosed arcs, ranging in current from 5 to 10 amp each, magnetite arcs, short-life yellow-flame arcs, long-life white- and yellow-flame arcs, low-periodicity lamps connected to opposite phases so as to eliminate frequency effect in light on the working level, and so forth.

The work is being extended and will eventually embrace all types of electric illuminants. Data are being compiled on the basis of operating cost per 100,000 British candle lumen hours, for 1000, 2000, 3000 and 4000 hour-years, and at various rates for energy. The figures include initial cost of installation, interest, depreciation, maintenance, and so forth. This entire demonstration is to be permanent and open at all times to engineers and others interested, and the data referred to will soon be available for general distribution.

LOW-PRESSURE STEAM TUREINES.

The combination of a high-pressure steam engine exhausting into a low-pressure turbine and the latter exhausting into a condenser was treated in a paper by Mr. J. W. Kirkland. The author claimed that this arrangement will improve the performance of many existing steam-engine stations, that have heretofore been uneconomical, to such an extent as to make them compare advantageously with many more modern and larger stations. While the best net economy of a combination of engine and turbine will be gained when the engines used are most efficient, the gain by the use of low-pressure turbines will be such as to produce very satisfactory saving in connection with engines of poor economy.

Test results were reported to show that by combining a low-pressure turbine with an existing steam engine, the combination using 50 per cent more steam than formerly, the output may be increased by 100 per cent. Low-pressure turbines are now used by the Philadelphia Rapid Transit Company, by the East St. Louis & Suburban Company, and in a street-railway generating station at Scranton, Pa.

ENERGY DISTRIBUTION IN SUBURBAN DISTRICTS.

Mr. George H. Lukes presented a paper discussing in detail the various factors affecting the distribution of electrical energy in suburban districts under the following heads: Transmission lines, details of line construction, substations, transformers, local distributing systems, secondary distribution, overhead construction, arrangement of wires on poles, voltage regulation, distribution losses, lightning protection, street lighting, underground construction, and pole-line records.

MAINTENANCE OF METERS.

A paper by Mr. H. D. King reported the results of tests tending to show that when watt-hour meters do not run at the proper speed the regulation will be incorrect, and if the speed is low, the central station will lose by reason of the energy not registered. He claimed that induction-type meters are more accurate and are more easily tested and calibrated than commutator-type meters.

MOTOR LOADS FOR SMALL STATIONS.

A paper by Messrs. Charles Robbins and J. R. Bibbins reproduced the load-curves of the Bradford (Pa.) Electric Light Company, using these as bases for discussions of the effect of motor loads in decreasing the cost of energy per kw-hour. Anaylsis seemed to show that the cost varied from 0.75 cent to 2.1 cent during the month of December, and from 1.0 cent to 2.3 cents during July. The station cost per kw-hour varies inversely with the load factor. The authors discuss the development of a motor load for improving the load factor, and outline methods for encouraging the use of motors. They state that central stations should undertake to sell the motors and install them ready for operation. They would then be able to advise with the consumer concerning the most desirable selection of units, the method of their control, and to assure for the users the many advantages resulting from their use.

TUNGSTEN LAMPS FOR STREET LIGHTING.

Mr. P. D. Wagoner presented a paper containing a large amount of data relating to various illuminants that may be used for street lighting and showing the superiority of the low-voltage tungsten lamps for this purpose. He stated that tungsten lamps have a life of 1500 hours when operated at a consumption of 1.25 watts per candle, the illumination remaining fairly constant throughout the life, while the illumination from a carbon-filament lamp decreases by from 25 to 50 per cent. The tungsten lamp can be operated satisfactorily at a frequency as low as 25 cycles, the flicker being more difficult to detect than that of the carbon-filament lamp.

For series street circuits the lamps are fed with energy from constant-current transformers at 4, 5.5, 6.6 or 7.5 amp. The lamps deliver 32, 40, or 60 cp, consuming 40, 50 or 75 watts.

N. E. L. A. BULLETIN AND HANDBOOK.

Mr. Alex. J. Campbell, editor of the *Question Box*, in a paper entitled "The Future of the Question Box" explained the part performed by the *Question Box* in the affairs of the N. E. L. A. It is a means of obtaining answers to specific questions, and also of exciting and maintaining interest in the association work among members who would otherwise take little part. Experience has indicated that better results can be obtained by introducing certain changes, and Mr. Campbell suggested that the recommendation of former-editor, Mr. Paul Lüpke, that a handbook be published be carried out, and that the *Question Box* be continued as a part of the monthly *Bulletin* now issued by the assiciation. He suggested that either a single editor or a committee be appointed to publish for next year a handbook that shall consist largely of compilations from previous issues of the *Question Box*, supplemented by such new material as can be gathered during that time. Immediately upon its publication there should be appointed a revision committee to produce a more complete handbook at the end of three years.

PROTECTION FROM LIGHTNING.

The committee on protection from lightning, of which Mr. R. S. Stewart was chairman, submitted a report dealing with lightning troubles during 1907. Data were received from 196 companies. Of these, 77 expressed themselves as satisfied with their lightning protection, and 86 as not satisfied. Those unsatisfied did not necessarily have any lack of faith in their existing types of arresters, for many of them felt that they needed more arresters or more effective ground connections. Of the 29 companies using overhead grounded wires, 24 expressed themselves as entirely satisfied with the results; the other five are dissatisfied because of breakage in the wire, and because of shocks to linemen. When heavy upper wires or galvanized-iron cables are used, the danger of breaking down is reduced to a minimum. If the overhead ground wire is insulated from the poles and if linemen use the same care in handling this wire as they use in handling the high-tension wires, there should be no danger of shocks.

The past year has been one of progress. Many of the central-station companies have studied the problem of lightning protection required by their own plants and have installed protective apparatus where needed. The engineering societies have contributed several valuable papers and discussions. The manufacturers have redesigned some of their protective apparatus so as to increase the efficacy. The shunted-gap arrester has been built with resistors of varying resistances; those of low resistances shunting a few gaps, those of larger resistances being connected across a larger number of gaps. The object of this design is to make the arrester sensitive to oscillations of both high and low frequency.

The most important development of the past year has been that of the aluminum electrolytic arrester, which has been given long service tests in several plants and has demonstrated its lasting qualities to the satisfaction of the manufacturers. Replies from four companies who have used aluminum arresters the past year indicate that the arrester has operated satisfactorily in actual service.

GRAVITY UNDERFEED STOKER.

Mr. S. J. Lenher presented a paper outlining the advantageous features of a form of stoker combining the underfeed principle with the inclined grate. He claimed that the combination eliminates all of the undesirable features of the horizontal fuel-bed, and retains all of the desirable features of the inclined grate; it does away with all necessity for manual disturbance of the fire and automatically deposits the ash and clinker on the dumpting plates at the bridge-wall, whence they are periodically dumped to the ash pit.

The stoker consists of a series of inclined air-boxes supporting stationary, horizontal, perforated cast-iron tuyére plates. Between each series of tuyére plates are placed two cylindrical rams, the upper ram feeding only such coal and coke as is delivered from the upper; the two rams move in unison, the upper having a travel of 10 in., and the lower a travel varying with the nature of the fuel.

The resultant of ram action and inclined grate is the gradual downward movement of the fuel-bed; the lower ram continuously breaks up the fuel, insuring a thorough mixture and proper distribution of air and depositing the ash on the dumping plate at the bridge wall. This dumping plate is unperforated, as combustion is complete before the ash reaches it; it is hinged to the blast-box which supports the inclined air boxes, and is operated from the boiler front. The dumping of the ash is a routine matter, governed by the nature of the fuel and rate of combustion. In practice, dumps are made in from three to six hours.

No special furnace or arch construction is required, and no supervision is necessary other than to maintain the proper relation between fuel-feed and air-supply. The author stated that under test with the stoker the combined furnace and boiler efficiency at 100 per cent rating was 70.6 per cent; at 125 per cent

rating, the efficiency was 79.8 per cent, and at 185 per cent rating, the efficiency was 72.7 per cent.

PHOTOMETRIC PRECISION.

A paper by Dr. A. E. Kennelly and Mr. S. E. Whiting described measurements, made by several observers, to determine the precision of four different types of photometers, designated as the "contrast," the "equality," the "concentric" and the "grease-spot," respectively. Each of these photometers was used with one homochrome pair and one heterochrome pair of luminous intensities.

In the homochrome comparisons the color of the light was that of carbon-filament lamps operating at a specific illumination of 0.24 mean spherical candle-power per watt (0.27 mean spherical hefner per watt). In the heterochrome comparisons, one color was that of a carbon-filament lamp operating at a specific illumination of 0.19 mean spherical candle-power per watt (0.21 mean spherical hefner per watt), and the other color was that of a tantalum-filament lamp operating at 0.55 mean spherical candle-power per watt (0.63 mean spherical hefner per watt).

The tests, which covered 31 sets of observations representing 850 individual balances, showed that the precision of a single balance in homochrome tests was about two and one-half times as great as that of a single balance in heterochrome tests.

In the homochrome tests the probable error in the ratio of nearly equal luminous intensities, for a single balance, was about:

0.5	per cent,	in	22	seconds,	for	the	contrast	photometer.
0.75	"	"	15	"	"	"	equality	"
1.0	"	"	17	"	"	"	concentric	"
1.5	"	"	22	"	"	"	grease-spot	"

The contrast photometer was thus three times as precise as the grease-spot photometer.

In the heterochrome tests, the probable error in the ratio of nearly equal luminous intensities, for a single balance, was about 1.66 per cent, in 16 seconds, from any of the types of photometer varying from 1.4 per cent to 1.9 per cent.

In the homochrome tests, the contrast photometer was distinctly superior in precision to any of the other types. In the heterochrome tests, however, the relative superiority of the contrast photometer was greatly reduced.

The error of an observer in measuring the ratio of two luminous intensities may be analyzed into a constant error, or constant personal equation of the individual, and an accidental or variable error of observation. The constant error, or "steady set," of an observer is presumably unchanged by taking a number of successive measurements; whereas the variable error, or probable error of accidental inaccuracy, is theoretically capable of being reduced, in the aggregate, by increasing the number of successive measurements in a series. Excluding all observations made with the grease-spot photometer, it appears from comparing mean ratios of luminous intensities by different observers on the same lamp setting, that the average constant error in homochrome tests was about one-third of the probable error of a single observation; but in the heterochrome tests it was about double the probable error of a single observation.

Constant errors of different photometrists can be detected and estimated only by comparing the mean ratio of luminous intensity obtained by the photometrists in successive series with the same lamp setting; whereas the probable error, or probable accidental inaccuracy, of a balance, or of a mean ratio of luminous intensity, can be determined for a single photometrist by permitting him to take a sufficiently long series of observations (say, 25) with the same lamp setting.

TAPE.

A paper by Mr. Paul Lüpke dealt with the "tape" used in the management of companies. He stated that in laying down the laws for a company the intimate interdependence of the departments must have most careful consideration, else there can be no successful parallel operation. The necessity for specialization under modern conditions often places at the head of a department a man whose knowledge of the operation of other departments is confined to what might be termed a course in the intra-company correspondence school, and in that case the value of an efficient clearing house cannot be overestimated. Without it rules will clash, the same information will be asked for in half a dozen different ways, multiplying uselessly the labor necessary to get it together, the general good will be sacrificed to the whim of the individual, meritorious effort will be strangled and ambition embalmed.

The company man needed and wanted is he who can stoutly and with ability defend his own opinion while a matter is under discussion and open to argument, and who, if overruled, is broad enough to bring his best efforts, with true loyalty, to bear upon making an unqualified success of the opinion that prevailed; in short, a company man must be able to abide by the decision of the court and go to work. Concerted action of men who have minds of their own must always be based on a compromise. There is need for honest, loyal, collective individualism.

JOINT POLE-LINE CONSTRUCTION.

A paper by Mr. Paul Spencer presented a detailed specification for the joint use of poles, which was recently prepared for the Public Service Corporation of New Jersey and for the New York & New Jersey Telephone Company by a joint committee representing the two companies. This committee consisted of Mr. John A. Barrett, electrical engineer of the American Telegraph & Telephone Company; Mr. Bancroft Gherardi, then chief engineer of the New York & New Jersey Telephone Company, as representing the telephone company, and Mr. Dudley Farrand and the author, as representing the electric-light company.

GROUNDING OF SECONDARIES.

The committee on the grounding of secondaries, of which Mr. W. H. Blood, Jr., was chairman, submitted a report discussing a rule which had been presented to the Underwriters for their consideration. According to this rule, transformer secondaries of distributing systems *must* be permanently grounded when the difference of potential between the ground and any part of the circuit would be less than 150 volts, but *must not* be grounded when the difference of potential between the ground and any part of the circuit would exceed 150 volts. The committee asked for the unanimous indorsement of a resolution showing desirability of having a rule of this nature inserted in the "National Electrical Code."

ECONOMICAL OPERATION OF THE SMALL CENTRAL STATION.

The subject of the design and operation of the small central station in a district having a population not exceeding 20,000 was discussed in a paper by Messrs. J. T. Whittlesey and Paul Spencer. The authors claimed that no piece of apparatus or any appliance should be installed that can not justify itself, not only on the basis of the economy promised by the manufacturer of the appliance, but also on the most conservative basis; full consideration being given to its first cost, its depreciation, the additional labor that its use may entail, and the question of extensive repairs, which can be made in a small plant only with difficulty. They give estimates tending to show that in a poperly-designed station having a load of 600 kw and an annual output of 1,320,000 kw-hours, the total operating cost should not exceed 1.4 cents per kw-hour with coal at $3 per ton. When the station equipment is increased to provide for twice the output, the operating cost should not exceed 1.17 cents per kw-hour.

HIGH-TENSION SUBSTATIONS.

Mr. S. G. Hayes outlined the general features and necessary equipment of stations receiving electrical energy over high-tension transmission lines, citing as examples the stations of the Niagara, Lockport & Ontario Power Company, the Chicago, Lake Shore & South Bend Railway Company and the Provincial Light, Heat & Power Company, of Montreal.

COMMERCIAL POSSIBILITIES OF TUNGSTEN LAMPS.

Mr. W. W. Freeman presented a paper containing a compendium of incandescent-lamp practice and opinions of member companies as to the value of high-efficiency lamps, including the graphitized-filament lamp with a consumption of 2.5 watts per candle, the 2-watt tantalum lamp and the 1.25-watt tungsten lamp. He outlined the policy of the Edison Electric Illuminat-

ing Company, of Brooklyn, with reference to supplying tungsten lamps, as noted on page 962 of our issue for May 9, and stated that every improvement should be encouraged and offered to the public upon reasonable terms at the earliest moment practicable. The tungsten lamp can compete successfully with the incandescent gas lamp on even terms as to cost, and with all of the superiority of electric service as a premium. The most inviting field for the immediate exploitation of the large tungsten units is in competition with the so-called "gas-arcs" now in use, which type of lamp can be rendered practically obsolete.

Underground Conduit System at Davenport, Iowa.

BY A. J. QUIGLEY.

About two years ago the electric light, railway and gas properties of the three cities, Davenport, Ia., Rock Island and Moline, Ill., were brought together under one management, and engaged in the engineering supervision and construction of the conduit system, will attempt in this article to bring out the principal engineering features of the work which may aid others confronting similar problems. While some of the details brought out necessarily have to do with local conditions only, the general plan is applicable to conduit systems in general.

The underground conduit was installed in a section fronting on the Mississippi River for a distance of 11 blocks and extending back from the river a distance of five blocks. In order to provide for present needs and for growth in the immediate future, the system was made up principally of nine and of 16-way duct from which four-way laterals branch out as required. It was estimated that approximately 250,000 duct-feet of conduit would be required, together with 50 large manholes and 200 handholes. On this basis local contractors bid on the work.

The electric-light company furnished the duct, manhole castings, handhole castings, steel reinforcement for manholes, and

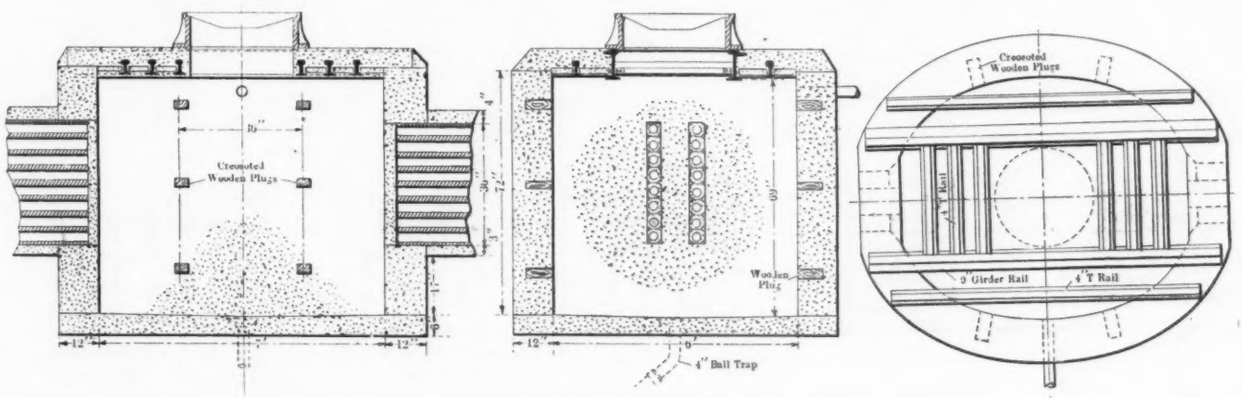


FIG. 1.—CROSS-SECTIONAL AND PLAN VIEWS OF STANDARD MANHOLE.

J. G. White & Company, of New York, took charge of the construction and reconstruction which this consolidation necessitated. These three cities, which practically form one community, show a combined population of about 100,000, half of which is in Davenport. Davenport City Councils in years past seem to have persistently advocated the principle of competition in public utility service. The result was that Davenport had iron pipe for laterals; the contractor furnishing all other necessary materials, such as cement. sand, lime, tools, mandrels, muslin for joints, etc. Figs. 1 and 2 herewith show the standard manhole construction, and Fig. 3 shows standard types for various multiple ducts. The trenches were excavated so as to allow a fill of 20 in. over the completed conduit, and were given such a width as to allow for 3 in. of concrete on each side of

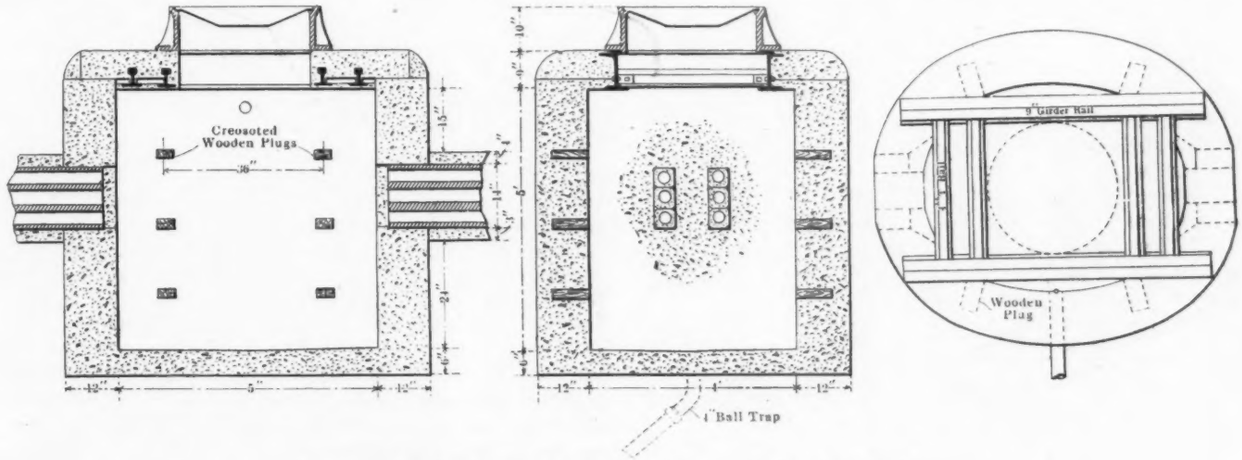


FIG. 2.—CROSS-SECTIONAL AND PLAN VIEWS OF STANDARD MANHOLE.

two electric light, two electric railway, and two telephone companies. The wires were so numerous as to be unsightly, and in some cases dangerous. As one of the first steps in bettering this condition, the City Council required the new company to construct in the down-town district of Davenport an underground conduit system to take the principal wires. The writer having been on the tri-city contract in the capacity of assistant superintendent from the beginning of the work, and actively the conduits and 3 in. on top. The conduit was laid on a bed of concrete 4 in. thick.

The conduit was laid so as to break joints and all joints were given a wrapping of muslin, over which was placed a 2-to-3 cement mortar. The conduit was laid with dowel pins and a mandrel and scraper were drawn through each conduit to insure alignment and clean interior. After the cement mortar at the joints had set, the tops and sides of the conduit were

covered with 3 in. of concrete. The grade is such that the ducts drain toward the manholes. Lines having more than 20 ducts are divided into two sections by a vertical fill of 3 in. of concrete. The composition of the concrete is one part Portland cement, three parts of sand, and six parts of broken stone. After completion each duct was cleaned and tested by drawing through it a brush and scrapers, and a test block of wood 20 in. long and 3 in. in diameter. On the end of the block was fastened an iron washer 3⅜ in. in diameter. In each duct was also left a No. 12 galvanized-iron wire running between manholes for the purpose of drawing in the cable.

The manholes have inside dimensions of 6 ft. x 7 ft., and a depth in the clear of approximately 6 ft. The floors and walls are of concrete 8 in. thick, and a sewer-tile drain is inserted in the floor of each manhole and connections made to the sewer. The roof of the manhole is of reinforced concrete construction, old rails being used as reinforcement. Wood strips are inserted in the walls as indicated to furnish means for supporting the cables.

The handholes are spaced three to the block. The standard handholes are 30 in. x 36 in. x 24 in. deep, and handholes

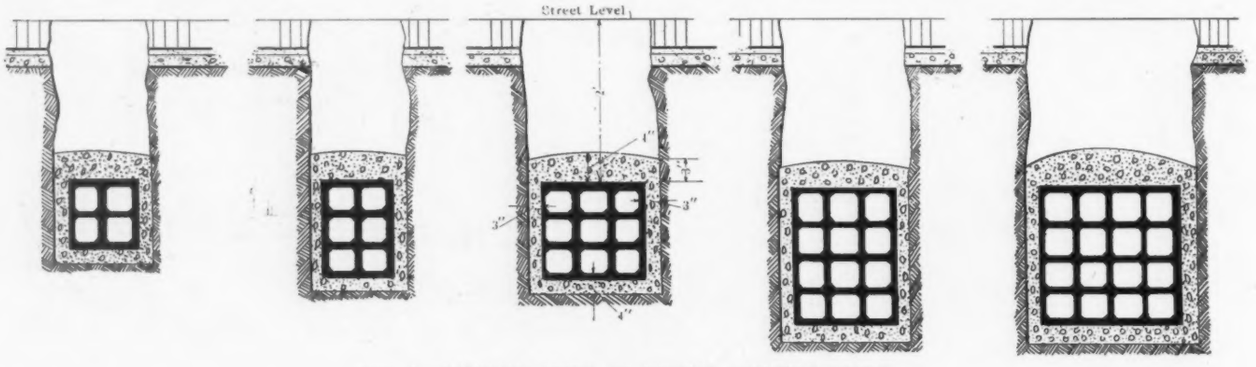


FIG. 3.—STANDARD TYPES OF VARIOUS MULTIPLE DUCTS.

24 in. x 24 in. are also used at the end of laterals. The walls of the handholes are 6 in. thick and are laid on a 4-in. floor of concrete. The standard depth for handholes is 2 ft. below street level. Suitable openings were left in the handholes for iron-pipe laterals to desired distributing points.

The contract was let at practically a lump figure under the above specifications, and work has been carried on in a satisfactory manner during this season. No trouble of any consequence was encountered with the exception of threading in the pull-in wires and trouble developed here largely because the extremely heavy rains of the early season had caused the ducts to be choked up with dirt. Even with this handicap, however, it was necessary to dig up only two places in the whole system. The mandreling was done by means of ½-in. iron pipe cut into sections about 5 ft. long, and one after another of these was screwed on and shoved through the ducts until in some cases a total length of over 400 ft. was being pushed into section. When connection between manholes had thus been established, a No. 12 galvanized-iron wire was drawn back, and the mandrel disjointed section by section.

Without giving exact costs on this system, it may be stated that duct should be purchased for slightly under 5 cents per duct foot, and the cost for the work of laying same complete should range from 13 cents to 6 cents per duct foot according to the number of ducts placed in one trench. In the Davenport installation, the number of ducts ranged from four to 21 per trench. The approximate total cost would show as follows, figures given to include all materials as well as labor:

250,000 duct feet of conduit laid, complete. Average for all styles, 12¼c.	$30,625.00
48 manholes, complete, including sewer connections, at $125	6,000.00
150 large handholes, at $58	8,700.00
50 small handholes, at $22	1,100.00
	$46,425.00
Add 7½ per cent for engineering, supervision and contingencies	3,482.00
Total	$49,907.00

The original estimate showed that $50,000 would be the cost of this system complete ready for the installation of the lead-covered cables, and judging by the results obtained here (assuming equivalent labor and material conditions) the writer believes a system of this size and style should be built in other like localities for approximately that amount of money.

The additional cost of lead-covered cables, subway transformers, etc., must largely depend upon the character of service being rendered and the amount of connected business. At the best, however, the cost for cables will be very heavy, easily running to five or six times the cost of the conduit system proper. Thus, in Davenport it is estimated that the lead-covered cables for the system will, when installed complete, cost the higher limit, so the cost will be:

Conduit system	$50,000.00
Cables for same	300,000.00
Total	$350,000.00

It will be seen, therefore, that the installation of an underground system for electric light and power work is a serious financial problem, the more so since no direct cash returns can be expected to accrue because of having made such an investment. Such expenditures must rather find explanation in the desire of the progressive management to satisfy, on the one hand, the demands of the public for civic improvements, and, on the other, the call from its own operating forces for improvements which tend to minimize possibilities of breakdowns.

New Telephone Patents.

DESK STANDS.

Now that telephone desk-stand sets, or portable sets, are so commonly used, the development of a set of this type cheap to manufacture and free from trouble has become very important. In response to the demand there are to-day a large number of very effective and well designed sets.

One feature to be considered with the desk-stand set is the weight of the base. Of course, the lighter the base the more easily the set is knocked over, while, on the other hand, a heavy base becomes of inconvenience to the subscriber because of the common practice of holding the set in the hand. Some designers favor the heavy base and some the light base. Among the latter is Mr. A. M. Knudsen, of Chicago, who recently patented a desk stand with a pressed thin sheet-metal base, the use of sheet metal being primarily to lighten the weight of the base. The sheet-metal base piece is strengthened within by an apparatus plate which supports the moving parts and which is secured to the end of the vertical stem tube. Mr. Knudsen has also included in his design certain improvements in the switch-hook with a view to simplifying it. He has assigned his patent to the Kellogg Switchboard & Supply Company.

COMBINED TELEPHONE AND FIRE ALARM SYSTEM.

W. S. McLewee, of Yardley, Pa., has been granted a patent for a combined telephone and fire-alarm system. With this system a signal box is associated with the subscriber's set, which box will cause the subscriber's line lamp at the telephone exchange to glow, at the same time a distinctive signal is given upon it, so that the operator may recognize at once that the

incoming call is a fire alarm. The operator is charged with the responsibility of observing the number of the called line and repeating this to the fire department, in order that it may know the location of the fire. The present patent relates chiefly to the details of construction and the connection of the apparatus.

TELEPHONE INSTRUMENTS.

A. E. Beecham, of Polkton, N. C., is the inventor of a new transmitter for loud-speaking purposes. The microphone button consists of a small glass tube, sealed at both ends, carrying two electrodes extending at an angle to each other throughout the length of the tube, each occupying about 30 deg. of the circumference, the nearer edges of the electrodes coming almost in contact. A mass of granular carbon lies upon the electrodes. The tube is exhausted so that the parts work within a vacuum. One end of the tube is secured to the center of the diaphragm and one loosely hung at the edge of the diaphragm. The diaphragm is used in a horizontal position. It is claimed that this transmitter will operate with very heavy currents without deterioration.

A novel type of receiver has been brought out by W. T. Boyd, of Ellenton, Fla. Mr. Boyd abandons the usual ear cap and substitutes therefor adjustable ear tubes, one of which is to be used with each ear. These ear tubes are designed to press lightly in the orifice of the ear, but to cling with sufficient power to support the receiver and leave both hands of the user free.

SERVICE METER SYSTEM.

From time to time there has been a demand for a call registering device to be located at the subscriber's premises and to be operated under control of the exchange whenever a call is successfully completed. I. Kitsee, of Philadelphia, Pa., has obtained a patent for such a system of registering calls. He provides at the exchange a switch, which, upon being depressed, throws upon the subscriber's line a battery of opposite sign to that used during normal signaling and conversation. The registering device is polarized and does not respond to the normal exchange current, but responds with one count to each application of the reversed current. As soon as a call is successfully completed the operator, by depression of this reversed battery key, sends out the recording potential upon the subscriber's line and registers the call at his station in his presence.

LETTERS TO THE EDITORS.

Telephotography.

To the Editors of Electrical World:

SIRS:—I was much interested to read your editorial in the issue of May 9, 1908, describing the Belin system of telephotography because of the fact that this "new" system is said to be the invention of a Frenchman, Edouard Belin, of Nancy. Your statement, "so far as we are aware, however, the up-and-down motion of a stylus upon photographically indented paper has not been brought out before" is in error, and the assertion that a swelled gelatine relief is used is also erroneous, because swelled gelatine reliefs are *soft* and have to have plaster casts made of them before they can be used otherwise. What is used is a wash-out gelatine after the same is developed in hot water and dried. This process was described in the ELECTRICAL WORLD of Feb. 17, 1900, on page 247, in an article contributed by myself. It—the Amstutz process—was also described in detail in the *Scientific American* of April 6, 1895; mentioned before the Royal Photographic Society of London in 1899, and redescribed in the *Inland Printer* of February, 1908. It was also mentioned by William Gamble in the *British Journal of Photography* of 1898, on page 70, and described at length in the book entitled "Beiträge zum Problem des Elektr. Fernsehens," by R. Ed. Liesegang, published in 1899 at Düsseldorf, Germany. Mr. A. Michaut, writing in the *Revue Universelle,* Paris, of May 9, 1895, after illustrating the machine, said, "In conclusion let us congratulate Mr. Amstutz on this new discovery with which he has enriched our civilization, and let us engrave his name on the most luminous pages of the Golden Book of Inventors of our country." *Le Genie Civil,* of Paris, May 18, 1895, also illustrated and described the process.

By way of corroboration, Mr. T. Thorne Baker, F.C.S., F.R.P.S., technical director of the Korn systems of photo-telegraphy, in London, on March 10, 1908, read a paper before the Royal Photographic Society on "Photo-Telegraphy" in which he said: "Mr. Amstutz, of Cleveland, worked out a method of transmitting pictures, which is of great interest, as M. Belin's recent invention for photo-telegraphy is practically identical with it. A photographic gelatine relief picture was fixed by Amstutz to a revolving cylinder, and a stylus traced a spiral path over the surface, rising and falling as the relief occurred and thereby varying the resistance in an electrical circuit. * * * Except that M. Belin uses the current variations to actuate a galvanometer and obtains a photographic impression by light instead of a mechanical power, the systems are practically identical. * * * Belin's method of transmitting pictures is an old one revived."

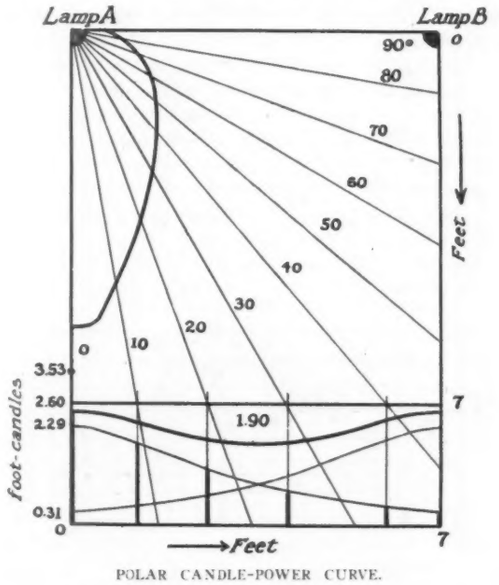
It is of interest to call attention to a United States patent application of mine, dated Jan. 19, 1891, in which the receiving was taken care of by means of a graded tint slide controlled in front of a lens system and a pinhole by the variable line current whose variations were modified by a selenium transmitter at the sending end. All of this early work was ahead of the psychological moment when the public demanded the introduction of such a system. Nevertheless, the merit of a claim of priority is independent of any psychological phases of the question.

CHICAGO, ILL. N. S. AMSTUTZ.

Uniform Illumination of Horizontal Planes.

To the Editors of Electrical World:

SIRS:—In your issues of Dec. 21, 1907, and March 21, 1908, articles by Mr. Alfred A. Wohlauer deal in an interesting manner with the uniform illumination of horizontal planes. These articles would be of much greater value if the author had not based his demonstrations on assumptions which are not realized in practice. Mr. Wohlauer has made use of a polar candle-



POLAR CANDLE-POWER CURVE.

power curve, the intensity of which decreases towards zero at 45 deg. from the vertical, and disappears beyond that angle. However, it is not possible to obtain a candle-power curve of the shape assumed by Mr. Wohlauer, even when reflectors are used, because they cannot reduce existing intensities; moreover, combinations of prisms and prismatic globes are quite unsatisfactory for this purpose.

If, as in all practical cases, the illuminant radiates light beyond 45 deg. from the vertical and in a horizontal direction, it is necessary to consider the light from all of the lamps sus-

pended above a certain surface to be illuminated. Referring to the accompanying polar candle-power curve, if the light from only one lamp is considered an illumination of 2.6 ft.-candles is obtained just below the lamp. If, however, the light from four symmetrically arranged lamps is considered, the illumination below one lamp will be 3.53 foot-candles, which value will be further increased when more lamps are used. Thus, the actual results are quite different from the conclusions reached by Mr. Wohlauer.

Berlin, Germany. Ernst W. Weinbeer.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Generators, Motors and Transformers.

Heating of Motors.—W. Hartnell.—A paper read before the Leeds section of the (Brit.) Inst. Elec. Eng. In modern machines the heat produced by losses in the teeth and armature disks is serious, with dense magnetic flux in the air-gap, and can be kept within reasonable bounds only when a moderate surface speed of armature is used, while the heat due to the carbon brushes is considerable with low voltages. With a surface speed of 1500 ft. per minute the loss due to friction and to the drop in volts between the carbon and copper may easily be equal to from 1.50 to 1.75 watts per ampere per brush. The heat thus produced can be dissipated only by heating the motor

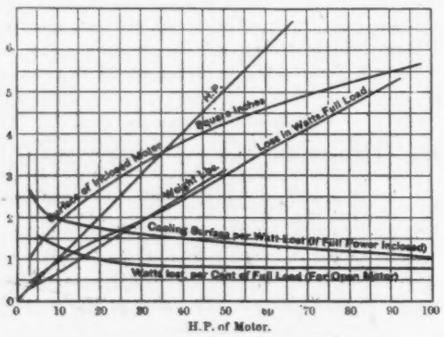

H.P.
Square Inches
Loss in Watts Full Load
Weight Lbs.
Cooling Surface per Watt Lost Of Full Power Induced
Watts lost, per Cent of Full Load (For Open Motor)
H.P. of Motor.

FIG. 1.—HEATING OF MOTORS.

itself, by radiation, or by conduction to a flow of cool air; that is, by ventilation. The relative change in the value of these effects, for a series of motors of an assumed average weight, cooling surface and loss of watts, as the size of the motor increases, may be seen from Fig. 1. In this diagram the vertical scale should be multiplied by one to get the cooling surface; by 10 to get horse-power; by 10 for loss in per cent; by 100 for weight in pounds; by 1000 for surface area in square inches, and by 1000 for loss in watts. The author also gives an account of several experiments which he has made. The heating and cooling of a magnet coil are shown in Fig. 2. The convex curve shows the gradual rise to a maximum temperature of an over-

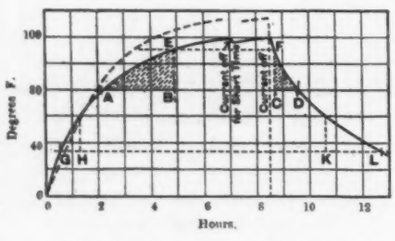


FIG. 2.—HEATING OF MOTORS.

loaded field coil of a dynamo (without an armature) and the concave curve the shorter interval of time to reduce the higher temperature after the current is cut off. Thus, in this curve, if any line *A B C D* be drawn, *A B* represents the time required for the temperature to rise by a particular value *B E* (measured outside the coil) and *C D* the time to cool. For the higher temperature which illustrates practical work *C D* is small compared with *A B*. The dotted line shows the average internal temperature calculated from the reduced current as the temperature rises. The coil was fully exposed to the air, and it was noticed that the temperature between the coil and the magnet ring was the same as outside the magnet ring near the pole. In enclosed motors the outside of the case may at times be 20 deg. Fahr. cooler than the magnet coils inside. The advantageous cooling with intermittent loads can be obtained only when there is a considerable difference of temperature between that of the air and the highest permissible temperature of the motor. If the air be very warm, so that this difference is comparatively small, the motor gets hot in less time than it cools. It will be seen in Fig. 2 that *G H* is less than *K L*. The final conclusion of the author is that totally-enclosed motors are under great disadvantages and that in general their use can be avoided.—Lond. *Elec. Eng'ing*, April 16.

Single-Phase Motor.—J. Mueller.—An illustrated article on the single-phase series motor of the Oerlikon Company. The motor is simply a series machine (with compensated armature reaction) provided with auxiliary windings which are so excited as to produce perfect commutation. One of its advantages is that it can be operated at will by alternating current or by direct current. However, the formulas of the author show that if the motor is to run at the same speed, the direct voltage alternating voltage should not be equal. For instance, if the alternating e.m.f. is not above 250 volts at the terminals of each motor the direct voltage for the same speed should not be above 225 volts. For use on ordinary traction systems it is therefore necessary to connect two motors in series.—*La Lumière Electrique*, April 11.

Train-Lighting Dynamo.—S. Iglesis.—Continuation and conclusion of his illustrated article on the Iglesis-Regner dynamo giving constant current at variable speed, and its application for train lighting. The principle of this machine has already been noticed in the Digest.—*La Lumière Elec.*, April 4 and 11.

Voltage Curves.—E. Siedek.—An article on the distortion of voltage curves in loaded single-phase and polyphase generators. The subject was studied by means of the oscillograph. The experimental results agree very well with the theoretical considerations.—*Elek. und Masch.*, April 5.

Lamps and Lighting.

Units of Illumination.—B. Monasch.—An article on the inconsistencies in the present international terminology relating to illumination. The author thinks that the unit lux should come into universal use. He refers to the great variety of units employed in several countries for candle-power, etc. The following conversion factors are given for units of illumination:

Results expressed in	1. Lux	2. Hefner-foot.	3. Candle-foot.	4. Candle-meter.	5. Carcel-meter.	6. Bougie-meter.
	Factor for conversion into desired unit.					
1. Lux (Hefner-meter)	1	0.0929	0.0848	0.9132	0.093	0.8849
2. Hefner-foot	10.76	1	0.9132	9.84	1.001	9.52
3. Candle-foot	11.78	1.095	1.	10.76	1.097	10.43
4. Candle-meter	1.095	0.1016	0.0929	1	0.1018	0.969
5. Carcel-meter	10.75	0.9986	0.9115	9.817	1	9.513
6. Bougie-meter	1.13	0.105	0.0958	1.031	0.1050	1

—Lond. *Electrician*, April 17.

Arc-Lamp Coupling.—An illustrated article on a new arc lamp coupling, with a description of the mechanical details.—Lond. *Elec. Eng'ing*, April 16.

Sockets.—L. Neumann.—Some recommendations on details of construction of incandescent lamp-sockets and fittings.—*Elek. und Masch.*, March 29.

Power.

British Power Company.—An abstract of last year's report of the North Metropolitan Elec. Power Supply Company, which

is now one of the most advanced companies selling energy in England. The number of kw-hours sold was 11,000,000, which is an increase of about 40 per cent over the value for the year before. The total cost per kw-hour sold, not including capital charges, was 1.73 cents.—Lond. *Elec. Eng'ing,* April 16.

Traction.

Surface-Contact System.—An illustrated description of the mechanical details of the Robrow surface-contact system which is being installed on a British tramway line.—Lond. *Elec.,* April 17.

Steam-Railroad Electrification.—L. H. PARKER.—An article reviewing the reason for the new tendency, its growth, application of alternating current and advantages of electrification, and giving some concrete examples and types of equipment.—*Stone & Webster Pub. Serv. Jour.,* May.

Installations, Systems and Appliances.

High-Tension Direct-Current System.—In high-tension direct-current systems it has been the usual practice to use a number of direct-current generators (each coupled to its prime mover) in series. It is necessary to insulate each generator from earth, and consequently the generators have been supported on insulating bases, and coupled by means of insulating couplings to their respective prime movers. A recent English patent of A. S. Highfield shows a method for avoiding the use of these insulating couplings. The prime mover, which, according to this invention, may be a large unit, is coupled to an alternator. The alternator supplies energy to a constant-current transformer, the secondary winding of which is divided up into a number of equal sections. Each of these sections supplies energy to a rotary converter, the direct-current sides of the rotary converters being connected in series. Only the rotary converters need be insulated from earth, and no insulating couplings are required. When the demand on the station is small, one or more of the converters can be short-circuited and this will not affect the current, as the transformer is designed for constant current. Instead of a single transformer, several in parallel can be used. —Lond. *Elec. Eng'ing,* April 16.

Wires, Wiring and Conduits.

High-Tension Cables.—C. FELDMANN AND A. HERZOG.—An illustrated translation in abstract of their recent German paper on the manufacture and testing of high-tension cables.—Lond. *Elec. Rev.,* April 17.

Calculation of Alternating-Current Lines.—A. BLONDEL.—A paper giving a résumé of the fundamental principles and formulas for calculating alternating-current transmission lines, taking into account inductance and capacity. The author takes up in succession the following problems: The determination of the constants characteristic of the line per unit of length; calculation of current and voltage at the end of the line as functions of the values at the transmitting end; the numerical determination of the different quantities either by a graphical method or by a trigonometric calculation. Numerical examples are given. —*La Lumière Elec.,* March 28.

Rise of Temperature of Conductors.—M. GACOGNE.—Usual formulas for calculating the rise of temperature of electric conductors assume its proportionality with the watts without taking account of the increase of resistance. The author considers separately operation at constant current and at constant voltage and calculates the rise of temperature, taking into account the change of resistance. The cooling effect is assumed to be proportional to the external surface and temperature elevation (Newton's law).—*La Lumière Elec.,* March 21.

Electrophysics and Magnetism.

Electric Discharges Through Gases.—J. J. THOMSON.—His concluding lecture before the Royal Institution on the general subject of electric discharges through gases. He gives the following illustration of the appearance of a vacuum discharge-tube: The cathode is like the power station where the conductivity of the gas is manufactured. The positive particles are drawn into the intense field of the cathode, and their bombardment causes the cathode to emit negative particles, which, repelled at great velocity, produce more negative (and simultaneously also positive) particles by their collision with the gas molecules. In the tube the current must be the same for every cross-section, and the current intensity can be maintained both by a large number of particles at low velocity and by a small number of particles at high velocity. In the cathode glow there are many particles and only a small velocity is needed. But further away from the cathode, particles are diffused and sent to the walls of the vessel, and if the current is to be maintained, the electric force must rise again. At such spots the particles will again attain a sufficiently high velocity to render the gas luminous; the increased number of collisions will then once more give more particles, the electric force will diminish, and in this way the bright and dark patches of the striations are obtained. Anything that will tend to increase the rate of loss of negative particles will bring the luminous patches nearer up to the cathode. It is the stream of negative particles from the cathode which carries the current. However, there is also a stream of positive particles from the anode, produced by the anode fall of potential, which, though to a certain degree dependent upon the gas pressure and the nature of the anode, is practically about 20 volts. While in gas discharge-tubes we have to deal with currents of milliamperes at very high potentials, arc discharges involved currents at several amperes at comparatively low potentials. In the gas discharge-tube the chief fall of potential is at the cathode, in the arc discharge at the anode. In the arc the gas plays only a secondary part and the phenomenon is practically a discharge of electricity from incandescent solids. The brush and point discharges also depend on the motion of electrified particles, which when traveling at velocities above a certain limit produce a fresh supply of negative particles by their collision with molecules. The same issue contains a paper by J. J. Thomson on the carriers of positive electricity.—Lond. *Electrician,* April 17.

Electrochemistry and Batteries.

Primary Cell.—A note on the Wedekind primary cell, which is a copper-zinc caustic potash cell. The positive element consists of a cast-iron case which also forms the outer containing vessel. The inner faces of this case are copper plated, and are provided with slots and pegs to hold the oxide of copper active material. The whole forms a solid black mass. During discharge this mass becomes red through conversion to copper. Recharging is accomplished by baking the case for three or four hours in an oven.—Lond. *Elec. Engineer,* April 10.

Electrolytic Art.—An illustrated article on a process used in England for producing bas-reliefs or art metal work by electrolysis. The process is specially used for the manufacture of flush switch plates, ornamental domes for surface switches, door plates, bell-push covers, etc. No details of the process are given.—Lond. *Elec.,* April 10.

Units, Measurements and Instruments.

Reichsanstalt.—An official report of the work of the (German) Reichsanstalt in 1906. The platinum-platinum-rhodium thermo-element was compared with the nitrogen gas thermometer for temperatures up to 1600 deg. C. The following formula gives the thermo e.m.f., E, of the standard element in microvolts for temperature t between 600 and 1600 deg. C.

$$E = 3{,}600 \log_{10}\left[1.3 + \left(\frac{t}{1000}\right)^2\right] - 1590.$$

The melting point of palladium was found to be 1575 deg. C. ± 10, that of platinum 1789 deg. The manganin standard resistors have well maintained their resistances. For electrolytic rectifiers with aluminum electrodes, neutral aluminum borate is very suitable as the electrolyte. An alcoholic solution of boric acid seems to allow the use of even higher voltages. A considerable amount of work was done on hysteresis. Special alloy steel for electrical purposes (containing silicon) has, in addition to other valuable properties, an unusual high initial permeability. Of incandescent lamp investigations, tests of 10 16-cp, 220-volt carbon-filament lamps are noted; the average useful life was 640 hours at the end of which the candle-power had dropped to 80 per cent of the initial value; the specific con-

sumption having simultaneously increased from 3.5 to 4.5 watts per horizontal hefner candle. A great many metallic-filament lamps were tested, also quartz-globe mercury-vapor lamps.—*Elek. Zeit.*, April 23.

Permeameter.—C. V. Drysdale.—A note on a (Brit.) Phys. Soc'y paper describing a plug permeameter which is an instrument in which a drill is employed to cut a conical hole in a casting or forging, at the same time leaving a pin 1/10 in. diameter standing in the middle. A wrought-iron plug carrying a bobbin with magnetizing and search coils completes the magnetic circuit, forming a miniature permeameter. The readings are taken by means of an ammeter and ballistic galvanometer in the ordinary way, or by the aid of a portable direct-reading test set. When this instrument was first used, it was found, as would be expected, that the values of the induction given by it were too low, and it had been supposed by some that this was due to imperfection in the magnetic joint. The author, on the other hand, had attributed it to end effects and to the shortness of the specimen. Investigations which have been made confirmed this view, showing that the amount of the end effect can be fairly closely compensated by correcting the value of H in the same ratio for all specimens. The instrument is accurate within 2 or 3 per cent, which is as satisfactory as most other permeameters.—Lond. *Electrician*, April 17.

Electric Measurement of Small Lengths.—M. A. Guillet.—A French Academy paper describing an electric method for measuring short lengths or displacements. The method is based on the variation of the mutual inductance produced by a very small displacement or by a deformation of one of the coils used. The method is extremely sensitive.—*La Lumière Elec.*, March 28.

Testing Insulators.—W. Weicker.—A fully illustrated description of the testing laboratory of the Hermsdorf porcelain works, which manufacture high-tension insulators.—Lond. *Elec.*, April 24.

Telegraphy, Telephony and Signals.

Induction Effects of High-Tension Transmission Lines on Telephone Wires.—O. Brauns.—A paper communicated from the German Imperial Telegraph Experiment Station and read before the Berlin Electrical Society. On some parts of the 34,000-volt, three-phase transmission system in the Urft Valley district, telephone lines are run within the neighborhood of the transmission lines and serious disturbances, due to induction of electrostatic charges, have been experienced. On one telephone line which had formerly an earth return, the disturbances disappeared after the line had been equipped with a full metallic circuit. But on branch connections of this line, which are equipped with single metallic conductor, the disturbances remain; they were due to electrostatic charges induced from the two-conductor main telephone line. By providing a proper earth connection for the latter, the troubles in the branch connections were removed. In this connection extended experiments were made by the Telephone Department. It was found that while electromagnetic induction from the transmission line appeared to have comparatively little effect on the telephone line, measurable electrostatic charges were induced from the former on the latter, even if the distance between the two was as much as 800 yards. On the basis of the experimental research, formulas have been worked out which enable one to predetermine the electrostatic effect with an accuracy sufficient for practice. If the currents produced by this effect in the telephone line are of the order of magnitude of 10^{-5} ampere, the telephone line must be equipped with a full metallic circuit. This construction removes the difficulties in sound transmission in this line itself, but the electrostatic charges are thereby not removed. Hence if this line has single conductor branch connections, troubles will be experienced in the latter. They are to be expected, if the induced e.m.f. in the main telephone line is above 5 volts. In such cases it is necessary to provide the main telephone line with suitable earth connections. Besides the troubles in transmission of speech, there may also be danger to persons touching the telephone wire. Under normal conditions there is no danger, but in the case of an accidental earth on the high-tension transmission circuit, the voltage induced in the telephone line may be increased 13 fold. The author sets up the requirement that under normal conditions a person touching the telephone line should not be subjected to an e.m.f. of more than 10 volts. It is shown that if a two-conductor telephone line runs for a length of 30 km (19 miles) at the side of a 40,000-volt transmission line a distance of 15 m (about 50 ft.), a person with an internal resistance of 2000 ohms will be subjected to an e.m.f. of 12.2 volts, when touching the telephone wire under normal conditions; this will be increased to about 160 volts in case of an accidental earth on the power transmission line. To prevent such accidents, proper earthing of the telephone line is necessary. The same issue contains an account of the discussion which followed the reading of the paper.—*Elek. Zeit.*, April 9.

Telephone Experiments.—Heilbrun.—An illustrated description of a lecture room apparatus for demonstrating the physical laws of telephony. The horn of a phonograph of simplest construction is removed and replaced by an elastic band while the pin which slides along the revolving record is fixed to the diaphragm of a microphone. The microphone, the source of current, the lecture-room galvanometer and a loud-speaking telephone are connected in series. If now the phonograph is started it does not send sound waves into the lecture room directly, but through the intermediary of the telephone. The sounds produced are said to be much superior to that of ordinary talking machines. With this arrangement it is possible to demonstrate quite a number of telephone laws; for instance, the influence of different frequencies, the relative advantages of different systems of connections, etc. The galvanometer needle is seen to make regular oscillations. Of course it does not reproduce the minute current oscillations of the microphone. The oscillations of the galvanometer needle are due to the fact that the mean value of the microphone resistance is considerably greater during the speaking period than when the microphone is at rest. This is most remarkable during whistling. It is, therefore, incorrect to state as is usually done that the resistance of the microphone during speaking oscillates around the value at rest. It really oscillates around another average value.—*Elec. Zeit.*, March 26.

Leakage and Insulation Resistance of Telephone Lines.—B. S. Cohen, B. Gati and C. V. Drysdale.—An article by Cohen referring to the statement sometimes made that an increase in leakage would considerably improve the transmission qualities of a telephone line. If, however, the practical application of leakage is considered, with the dimensions of the factors for the general run of commercial telephone lines, any increase in leakage sufficient to give the distortionless condition is accompanied by such an increase in attenuation as to render the line unworkable in a great majority of cases. The author takes exception to two statements in the recent paper of Drysdale. He emphasizes that quite a considerable deviation from Heaviside's theoretical distortionless condition is not only permissible but desirable. In conclusion he says that telephone engineers should not imagine that low insulation on telephone lines may, so far from being a disadvantage, even prove beneficial from a transmission point of view. So far from this being the case, it is essential that all lines, whether cable or open wire, loaded or unloaded, should be kept at the highest practical insulation point consistent with due economy.—Lond. *Elec.*, April 10.—B. Gati expresses in a letter the opinion that the Boer War cost Europe the belief of telephone engineers in high insulation. All telephone cables are badly constructed because cable manufacturers thought that the insulation resistance for direct current and the dielectric resistance for telephone frequencies are the same thing. But the dielectric resistance in a telephone cable is never as high as one megohm at a telephone frequency of 1000 periods per second. The term insulation resistance is misleading. There is considerable loss due to dielectric hysteresis and electrostatic influence. These reduce the effective value of the insulation resistance. C. V. Drysdale replies briefly to Cohen and Gati with whom he agrees in a general way.—Lond. *Elec.*, April 24.

Alternating-Current Transmission in Cables.—B. S. COHEN.—A reply to the recent letters of Gati and Drysdale. The writer thinks that the cable manufacturers are quite justified in attaining and maintaining high insulation. The cost of attaining high insulation in paper-insulated cables is not by any means an expensive item in cable construction. The question of variation of insulation, when measured by direct current, and by alternating currents of the nature of those with which the cable is actually used, emphasizes the importance of making all measurements with speech-frequency currents, and the introduction of simple and reliable methods of producing and using such currents is undoubtedly of the first importance.—Lond. *Elec.* May 1.

Demonstration of the Propagation of Alternating-Current Waves in Cables.—C. V. DRYSDALE.—A note on a (British) Phys. Soc'y paper, in which the author describes a vacuum-tube apparatus for demonstrations of this kind. The propagation of alternating-current waves in conductors has been frequently exhibited by the aid of a helix, notably by Fleming and G. Seibt, and the former has proposed the use of vacuum tubes to show the distribution of potential. The author had noticed that in a tube laid parallel to the helix the brightness was proportional to the slope of potential and, hence, to the current. The apparatus, therefore, consisted of a wooden stand which supported a helix about 6 ft. long, a vacuum tube just above it and a series of 18 vertical tubes below it. On feeding the helix with energy from a high-frequency resonance circuit, nodes and loops of potential and current were simultaneously visible in the two sets of tubes, and these were approximately in space quadrature with one another. Experiments were shown in which the frequency of the supply was varied, and the capacity of the helix was altered by introducing an earthed wire inside it. Resistance, capacity and inductance were also connected successively to the receiving end, and the effects were approximately in agreement with theory.—Lond. *Elec.*, April 17.

Telegraph and Telephone Cables.—F. TREMAIN.—A paper read before the New Castle section of the (Brit.) Inst. of Elec. Eng. on the construction and use of paper-insulated lead-sheathed telephone and telegraph cables.—Lond. *Elec.*, April 24.

Testing Telephone Cables.—B. GATI.—If telephone cables are tested with direct current only, the insulation resistance alone is measured, while all other losses which occur with currents of the frequency of telephone currents are not considered. The author shows that the total effective dielectric resistance of a telephone cable may be directly determined by means of the barretter.—*Elek. und Masch.*, March 29.

Wireless Transmission of Photographs.—An illustrated description of the method of H. Knudsen for transmitting photographs by a wireless method. In this system the transmitter consists essentially of a traveling carriage, operated by clockwork, carrying a light style moving backward and forward. The style travels over the surface of the picture to be transmitted so that every part of the surface is traversed once during the complete operation. Mechanical action alone is relied on for giving the radio-telegraphic impulses, the style being normally at such a height that a gap exists in the relay circuit controlling the current to the primary of the coil. If the style is pushed up, a contact is made completing this circuit. In order, therefore, to operate this system, it is necessary to so prepare the picture that those parts which are dark are in relief as compared with the parts that are light, or vice versa. This is effected by "dusting" the usual photographic negative with a powder (for example, of iron), which adheres to the dense parts of the negative, but not appreciably to the transparent parts. The sensitive plate on which the photograph is taken is made with a much thicker film of gelatine than usual; after development, and before it is quite dry, it is "dusted" with the powder, which adheres to those parts that are most damp (that is, the dense parts), but not to the parts that are dry. Thus the dense parts of the negative become raised. Consequently, when the style traverses a dense patch, waves are transmitted. The receiver is a similar instrument, but in this the style is normally raised, being depressed when a wave is received, this being effected by a coherer and relay circuit. The plate for receiving consists of a glass plate with a blackened surface; experimentally lampblack may be used, but in practice some more permanent coating would be adopted. In this way a negative is at once obtained corresponding with the original picture or negative. It is found that a quarter of an hour is sufficient to transmit a 5-in. by 4-in. picture.—Lond. *Elec.*, May 1.

Wireless Telephony.—V. POULSEN.—An illustrated lecture held at the London Institution, dealing especially with a comparison between the properties of damped and undamped waves. A small-scale demonstration was made by telephony without wires in the lecture hall. It was stated that sound has been transmitted electrically over a distance of 460 km (about 280 miles) without wires.—Lond. *Elec.*, April 24.

Undamped Oscillations.—O. M. CORBINO.—A paper describing a new method of obtaining undamped oscillations with a shunt-wound motor, without condenser, being based upon the following principle: A shunt motor, with armature and field magnets of laminated iron, when subjected to an alternating sinusoidal potential difference applied to its terminals, behaves like an inductive resistor whose inductance may have a negative value. Hence, the apparatus is equivalent to an inductance in series with a capacity. For a certain speed the inductance and the equivalent capacity are independent of the frequency. The formulas for determining the conditions are given under which the system may be transversed indefinitely by alternating currents having a certain period of oscillation.—Lond. *Elec.*, April 24.

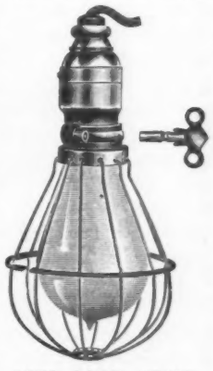
Miscellaneous.

Works Management.—E. THOMAS.—A paper read before the Manchester section of the (Brit.) Inst. of Elec. Eng. on the principles of management of engineering workshops, with special reference to shop routine, lists of materials, drawings, records, etc., and the day-work as compared with the piece-work or premium system. In the discussion which followed, C. C. Gerard gave a detailed description of a cost-keeping method in use by the Ferranti Company.—Lond. *Elec. Eng'ing*, April 16 and 23.

Brit. Inst. Elec. Eng.—Mr. W. M. Mordey has been nominated for president for next year.—Lond. *Elec.*, May 1.

New Lock Lamp Guard.

The elimination of a serious problem which confronts every user of incandescent electric lamps, that of having his lamps stolen, seems to have been practically and cheaply overcome. The Crescent Company, Valparaiso, Ind., is placing on the market a new lockable lamp guard, styled the "Protector L" by the makers. As shown in the cut herewith, the wires forming the body of the guard are anchored by one end in the button at the point in such a way as to permit of a hinge movement of the two halves of the guard. This allows for the ready insertion of the lamp. The wires at the other end are rigidly made fast in a stamped steel collar. In the construction of this collar lies the salient feature of the guard.



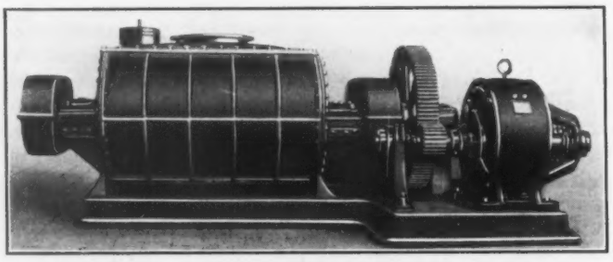
LOCK LAMP GUARD.

The collar consists of two segments, each segment having ears at both ends to correspond with the ears on the opposite segment. One of these ears is threaded to receive a small lock screw carried in and made part of the corresponding ear of the opposite segment. The head of this lock screw is counter sunk in a metal collar made part of the ear which carries it. By means of these screws and threaded ears it is possible to lock rigidly the guard to the lamp socket with what is aptly called a "Bull-dog grip." The manner of placing the metal collar, together with the triangular shape of the screw head, makes it impossible to remove the guard in any way, other than by using the key furnished with the guard for that purpose. There are no detachable or loose parts to the guard which

can be misplaced or get out of order. The guards are light in weight, have a neat, trim appearance and are turned out in a silver luster finish, making them not only serviceable in factories, shops and like places where they are apt to receive rough handling, but also in offices, theaters and amusement places, hotels, or in fact anywhere where good appearance is a factor.

Foundry Blowers.

In the average foundry power is required for but a short time in the afternoon to operate the blower. When once a heat has been started the supply of air must be kept up until the heat is off. This requires a source of power which is absolutely reliable. As the demand is very heavy at this time and but small at all the remaining time, as low an investment cost as possible is desirable. For these reasons electric motors are being adopted by foundrymen as the most satisfactory power, especially where current may be purchased from a central station. Electric drive by power that is thus supplied shows many marked advantages over all other methods.



FOUNDRY BLOWER.

The illustration shows a very satisfactory blower driven by an electric motor suitable for foundry work. The blower is manufactured by the P. H. & F. M. Roots Company and the motor by the Westinghouse Electric & Manufacturing Company. The sturdy appearance of this outfit is readily observed, and the reliability under hard service fulfils the promise made by the appearance. The use of adjustable, self-oiling bearings is a particularly satisfactory feature of these blowers.

The blowers are designed for a range of speed variation of approximately 1½ to 1 to allow a variation in the melt to be made if at any time this becomes necessary. For this purpose direct-current motors are frequently used, as they permit the desired changes in speed, when specified in ordering the motor. In many installations it is not necessary to be able to adjust the speed of the blower, so that the constant-speed characteristics of the induction motor permit its use where alternating current is available. A large number of applications have been made in this way and have given entire satisfaction.

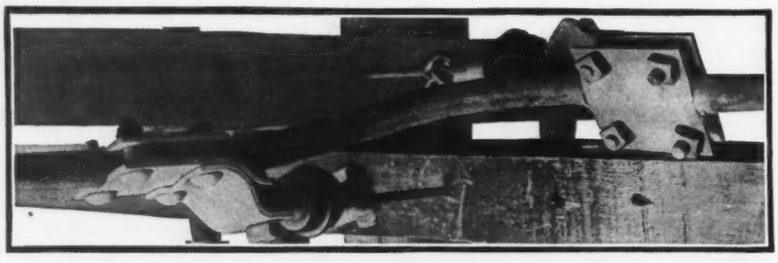
The approved method of driving is by gearing direct from the motor, permitting the use of a moderate-speed motor, thus reducing the original cost, and at the same time doing away with belt drive, which is not entirely satisfactory. The selection of the size of the motor depends upon the conditions to be met in the foundry. In general, a pressure of 16 oz. may be considered as a fair value for the blower to meet. As the capacity required in the motor is approximately 5 hp for every 1000 cu. ft. of air required per minute at 16-oz. pressure, the required size of the motor is readily determined, when the capacity of the cupola is known. An allowance of 30,000 to 33,000 cu. ft. of air is usually made to melt one ton of iron.

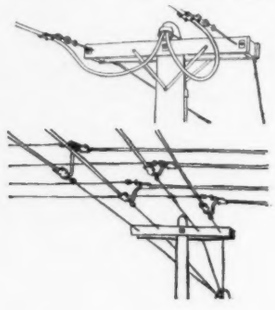
As the pressure may increase slightly above 16 oz. toward the end of the heat, the power required also increases. But the overload capacity of the motor is able to take care of this increase. If the pressure is to be materially different from 1 lb. for any long-continued period, the motor capacity should be determined with this in mind. The power will increase or decrease in direct proportion to the increase or decrease in pressure.

The purchasing of power from a central station is attractive to the average foundry, because the central station can actually sell the power cheaper than the foundry can make it. This is because the central station can use its machines for supplying power all through the day to other persons and, therefore, does not receive all its investment returns in a few hours, as the foundryman would have to do if he invested in an electrical plant.

Erection of Aerial Cable Lines.

In order to make a "spliced corner" in an aerial cable line there is required a length of from 3 ft. to 4 ft. of cable, while from 8 ft. to 10 ft. may be thrown away at each end. A considerable loss is occasioned by linemen estimating the length necessary for the splice, an excess being allowed in each case in order to be on the safe side. When it is considered that the time consumed in making a splice may amount to three hours, by three men, it will be appreciated that a "spliced corner" is an expensive part of a cable line. It is claimed that by the use of Kearney cable clamps there can be made a saving equal to twice the cost of the clamps. A good view of the clamps is given in Fig. 1, while the other illustrations show a number of the uses to which the clamps can be put in aerial cable lines. These clamps are manufactured by W. N. Matthews & Brother, 219 North Second Street, St. Louis, Mo.





FIGS. 1, 2 AND 3.—CABLE CLAMPS IN USE.

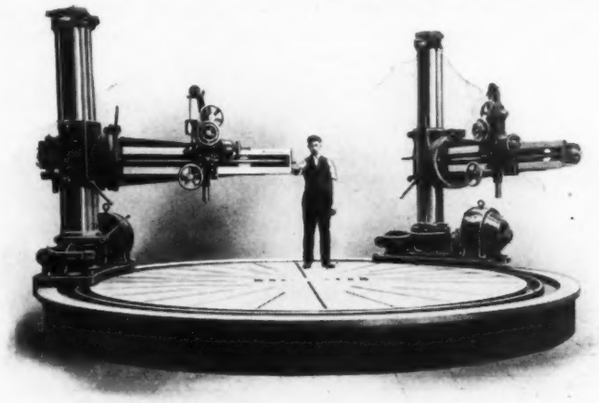
Universal Radial Drill.

The accompanying illustration shows a 6-ft. universal radial drill, which has recently been constructed by the Niles-Bement-Pond Company for exportation. As will be noticed, there are two drills mounted on a single 20 ft. bed-plate and each drill is independent of the other. The power for each drill is provided by a 5-hp Westinghouse motor mounted as a part of its drill. The adoption of an interpole motor was decided upon to provide for a wide range of speed without mechanical speed-changing devices. The motor selected can be varied from 400 to 1600 r.p.m., and will deliver its full rated horse-power for 12 hours continuous service at any speed within its range.

The motor is used not only for driving the spindle, but by a special clutch may be made to move the column about the bed-plate and bring it to any desired position. Either direction of traverse may be obtained by a reversing switch, which is not shown in the illustration. The use of a variable-speed interpole motor of wide range permits the drills to be run at all

times at their maximum speed, regardless of the size of hole to be drilled, as the speed of the motor may be varied by small steps to suit the work being done. To provide for the circular movement of the columns by mechanical drive would have been very difficult, if not impossible. By the individual electric motor the difficulties are overcome in the simplest manner.

As each drill column must move half way around the bed-

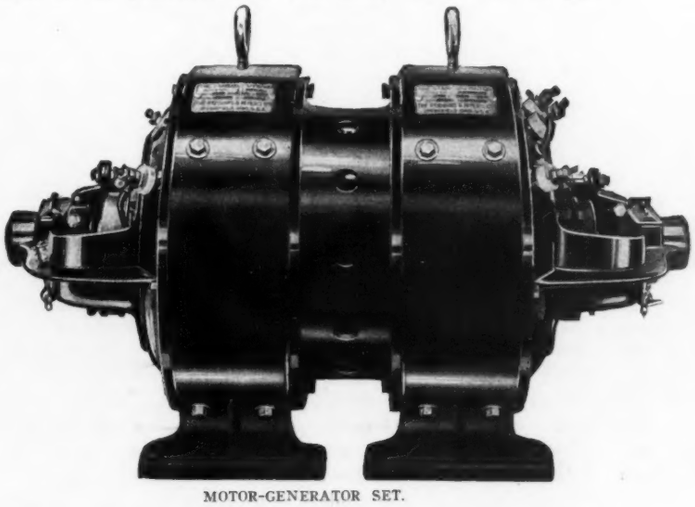


UNIVERSAL RADIAL DRILL.

plate, an armored cable protects the wires connecting to the motor and supplies the necessary flexibility. The controllers for starting and governing the speed are mounted one on either side of the bed-plate on a special frame, which also carries a double-pole, double-throw switch for reversing the direction of rotation of the motor.

Motor-Generator Set.

The motor-generator set illustrated herewith comprises two regular motor or generator frames supplied with the regular commutator end heads and joined together by a ventilated union ring, which brings the machines into rigid alignment. The shaft, which runs clear through and is journaled in the outer end-plates, has two armatures mounted upon it, one of which may be wound for any suitable voltage direct current, and the other of which may be wound for either alternating or direct current of any practical voltage. Both sets of fields are connected with the motor line, and the generator winding is compounded so as to give any characteristic desired to the voltage, the motor armature-current passing through the series coils on the generator end. The shunt winding of the gen-



MOTOR-GENERATOR SET.

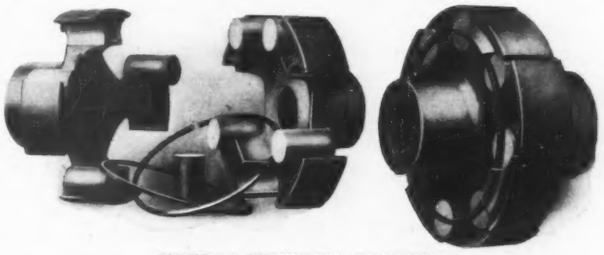
erator is usually provided with a rheostat for adjusting the voltage, while an ordinary motor-starter is used on the motor end for starting and stopping the set.

When used for alternating current, the machine is ordinarily wound to run at 1800 r.p.m., thus giving a frequency of 30 cycles when equipped with two poles, 60 cycles with four poles, or 120 cycles with eight poles. By using a field rheostat in the motor end, the speed may be varied to adjust the frequency over quite a wide range, as desired.

These motor-generator sets are quiet in operation, of high efficiency and much more compact than when built as separate machines, mounted on sub-base and coupled together with the usual couplings and in the usual manner. For charging storage batteries, when wound for direct current, they are found useful, and in signaling and wireless telegraph work they are usually wound for delivering alternating current. When of the latter type and intended to be used on shipboard, they are provided with substantial thrust bearings for counteracting the effect on the armatures of the rolling of the ship. These sets are manufactured by the Robbins & Myers Company, Springfield, Ohio.

Flexible Insulated Coupling.

The accompanying illustration shows an improved flexible insulated coupling manufactured by the R. D. Nuttall Company, of Pittsburg, Pa. The coupling consists of two interlocking spiders of cast iron, which are insulated by means of rubber cylinders. Aside from these the only other parts are two steel rings used to hold the rubber cylinders in position. The rubber members provide ample insulation and, at the same



FLEXIBLE INSULATED COUPLING.

time, give the desired flexibility. The coupling is made in sizes from 5 hp up.

This flexible coupling is especially desirable where electric motors are direct-connected to machinery which is subject to vibration, as, for example, a tube mill or a coal pulverizer in a cement plant, where the coupling relieves the motor from the shocks and jars of the machine. In addition, the end thrust of the crusher is overcome and the motor bearings run without undue heating.

Standard Electric Light Pole.

POLE.

The accompanying illustration shows a standard electric-light pole manufactured by the Pittsburg Pole & Forge Company, of Pittsburg, Pa. The pole is made up in a number of lengths and with a number of various cast-iron bases and equipments for carrying both wires and arc lamps. The main feature of the pole is the solidity of the joint or joints, as the case might be. In the pole shown the sections are joined by a patented hot process giving a solid swedged joint having the same diameter and thickness the entire length. It is said to be impossible to telescope the sections by overloading or by hydraulic pressure; the pole bending before the joint gives. The joint is also said to be proof against corrosion by water. The Pittsburg Pole & Forge Company has done much in the way of original designing to meet certain practical requirements, and consequently it is not at all uncommon to find its poles used in many of the large cities of the United States.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Trade, on the whole, during the week, was somewhat better than during the preceding week. Good crop reports and the belief that the securities market is a forecast of improved conditions, is doing a great deal to inspire confidence, although caution is the watchword. Collections showed considerable improvement, especially in New York City, and money is easy, with low rates for long time loans being conspicuous. Railway earnings for April showed a decrease of 19.9 per cent from April, 1907, the largest monthly decrease as yet reported. April exports showed a decrease of 5.7 from March, and 15 per cent from April, 1907. Some increased demand was felt in the iron and steel lines, and the feeling prevails that the bottom has been touched in those trades. Bank clearings were smaller than for the preceding week, which were, however, the largest in six months. The various electric companies report an increase in orders over the previous week and a firmer tone to the situation. The Allis-Chalmers Company is in a stronger position physically as well as financially, than it was a year ago, and lately has obtained several good-sized contracts for work which were held up on account of the panic. The next annual report of the company, it is predicted, will show a marked contrast to the last annual report, with its deficit of $225,000. The company is operating about 65 per cent of its capacity. According to the officers of the Westinghouse Electric Company, there are enough orders on hand at present to keep the plant at Pittsburg busy for some time to come. As yet, owing to economies in production, it has not been found necessary to increase the working force. The General Electric Company and the Western Electric Company, report an increase in demand for finished products, though the totals are still far behind the totals of a year ago. The export business continues to be the strongest feature of the situation.

MR. MARCONI ON TRANSATLANTIC COMMUNICATION.—At a recent meeting of the Marconi Wireless Telegraph Company in London Mr. Marconi expressed himself as satisfied with the progress of transatlantic wireless communication and said that the results of the work done during the last 7½ months had confirmed his belief that transatlantic service has and will furnish a new and economical means of communication between America and other distant countries. He said: "Experience shows what modifications and extensions will be necessary for continuous operation on a 24-hour basis at high speed. It also shows what obstacles, such as interference with other stations and the difficulty of transmitting from long distances during the daytime, will have to be overcome. For some months the majority of our messages have been carried across the Atlantic during the day, and no interference with ship-to-shore communication has been caused by the powerful long-distance transatlantic stations. There has been no attempt to work up high speed, but as high as 24 words a minute have been achieved, and with slight modifications I am convinced that as high as 30 words a minute can be attained. As the result of a recent development it will be possible to effect duplex working, so that each station may send at the same time it is receiving. This arrangement applied to transatlantic stations would double their effective rate to 60 words a minute." The company authorized 250,000 7 per cent shares for extension of operations. It was stated that the maritime branch of the company had placed instruments upon 118 ships up to the close of 1907, and that the number of words transmitted during the year was 1,868,540, with net receipts of £37,935 ($189,675).

WIRE INSPECTION BUREAU.—In reply to circular letters sent out by the Wire Inspection Bureau to inspection departments all over the country asking their co-operation with the bureau to maintain a high standard of service and to notify the bureau promptly of any wire which did not appear to be up to standard and help the bureau to obtain samples of such wire, many very favorable replies were received, which indicate that the bureau can count on effective co-operation from the majority of the inspection departments. These replies are encouraging to the bureau, as the efforts now being made to maintain a high standard for code wire will be greatly aided by such assistance, and they seem to substantiate the views held by the bureau that the best interests of municipality and insurance departments will be served by inspectors continuing their co-operation with the Wire Inspection Bureau.

MOTORS FOR LINOLEUM PLANT.—A feature of the new power-house equipment of the Nairn Linoleum Company, at Kearney, N. J., will be the 1000-kw, 60-cycle, Allis-Chalmers steam turbine alternator purchased some time ago. In addition to the installation of this unit in the power-house, contracts have recently been placed for 28 Allis-Chalmers induction motors ranging from 5 to 50 hp in capacity and aggregating 850 hp. The installation of these motors for driving a portion of the factory marks the beginning of its conversion from mechanical to electrical drive throughout the entire plant. The Nairn Linoleum Company is one of the largest establishments of its kind in the world, being a branch of the Scotch company, located at Kircaldy, near Edinburgh, Scotland. The American plant is on the Passaic River, from which the condensing water for the turbines is obtained.

WIRELESS STATION FOR PLAZA HOTEL.—The guests of the Plaza Hotel, New York's newest and largest hostelry, will shortly be able to communicate with friends on transatlantic steamers without leaving their apartments. The work of installing a wireless station on the hotel roof, 319 feet above the street level, has been begun, and the three steel flagstaffs already on the roof reduces to a minimum the expense of constructing the station. The De Forest system will be used, and the management of the hotel will own the station, which it will build and operate. An operator will be at the station every day, and arrangements will be made for telephone communication between the operator and every room in the hotel.

NIAGARA ENERGY FOR SYRACUSE & SOUTH BAY RAILWAY.—A new substation will be erected for the Syracuse & South Bay Electric Railway Company, of Syracuse, N. Y., to receive energy from the transmission lines running from Niagara Falls to Syracuse. After the e.m.f is reduced from 60,000 volts to 500 volts, the energy will be used to operate an extension of the Syracuse & South Bay line. The order for the equipment of the new substation, consisting of transformers and switchboards, was placed with the Westinghouse Electric Company last week.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has applied to the Secretary of State to increase the capital from $125,000 to $1,250,000. The old capital was all common, and the new issue will consist of $500,000 6 per cent preferred and $750,000 common stock. Most of the new capital has been subscribed, and the money received for the stock will be used in erecting a new plant at Oakley, Hamilton County, in the near future.

ROCKY MOUNTAIN TELEPHONE COMPANY STRIKE SETTLED.—The strike of linemen and operators of the Rocky Mountain Bell Telephone Company, which has lasted for nearly a year, and almost completely paralyzed the Bell telephone business in Butte, has finally been settled. In the agreement which the company and labor unions have signed, and which will be in force for a year, the company yields almost every point and dismisses the injunction suits which the company brought against the labor unions.

TURBINES FOR BUENOS AIRES.—An Italian firm in Legnano, Italy, has just completed a 12,000-hp steam turbine, which is said to be the largest hitherto built in Europe. This turbine is the first of three machines to be manufactured for a generating station which the firm is installing at Buenos Aires. The consumption of steam guaranteed by the makers of the new 12,000-hp turbine is 13.86 lb. per kw-hour.

PLANT FOR JACKSONVILLE, FLA.—The municipal lighting plant at Jacksonville, Fla., has contracted for another 1500-kw Allis-Chalmers turbine, and one 300-kw motor generator.

THE COPPER MARKET.—A decided change for the better, in sentiment at least, was noticed in the copper market during the last week, a feeling of optimism that found its reason for being, perhaps, in the strength of copper stocks, since the metal conditions changed but little, and prices gained only about ⅛ of a cent a pound. All the leading copper interests insist that the copper metal situation shows distinct improvement, not only for export, but also for domestic consumption. The railroads are still out of the market, but there was an increase in inquiry from street railroads, and it is expected that they will be in the market for large amounts as soon as the matter of bond issues has been settled satisfactorily. American consumption is still about 50 per cent below normal, but it is claimed that few producers are selling below 13 cents, and that stocks are not accumulating. The foreign demand continues good, with an indication of still heavier demand from England and the Continent. Advices from abroad state that the copper consumption in Germany for the first three months of the current year was 77 per cent larger than for the corresponding period last year, and that in England the increase of consumption for the same period was 40 per cent, and in France 15 per cent. The domestic situation is still far from satisfactory, but should confidence continue to gain strength in the next few months, as it has in the last few months, there will undoubtedly be a rush to buy copper, as there has been formerly, under conditions similar to those that prevail now. On Monday there was an advance of ⅛ of a cent on both spot and future deliveries. Closing prices on the Metal Exchange were as follows:

Lake	12.75 @ 12.87½c.
Electrolytic	12.62½ @ 12.75
Castings	12.37½ @ 12.62½

The London market was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	58 5 0	58 10 0
Standard copper, futures	58 17 6	59 5 0
Market	Firm.	Firm.
Sales of spot		200 tons
Sales of futures		1,100 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£65 10 0
London, futures	64 10 0	56 17 0
London, best selected	67 10 0	60 5 0

WESTINGHOUSE BUSINESS IMPROVEMENT.—During the opening week of May the business of the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company has, it is stated, for the first time since last October shown an improvement of a character which recalls the busy days of last year. While there have been indications of an improvement in the business of both companies, ever since the first of the year, the increase was very slight and the orders were mostly confined to those departments engaged in the manufacture of smaller apparatus for the large electric lighting, railway and power plants which needed the additional apparatus to keep up with the natural growth of their business. New business has been very scarce so far, because electrical enterprises contemplated last year received a set-back with the financial depression of last October. It is stated, however, that the orders received by the Westinghouse companies during the first two weeks in May, several of which are of fairly good size, confirm the opinion that business confidence has again returned. A large addition to the forces in the shops has as yet not been necessary, because the methods of economy and improvement in the production departments inaugurated last year at the East Pittsburg plants are amply adequate to cope with the new work, although there have been a number of operatives added as the occasion demanded it. Among the contracts received is one from the Berwind-White Coal Company, of Windber, Pa., for the complete installation of a central mining plant, consisting of steam turbines, turbo-generators, rotary converters, transformers, motors and switchboard appliances. This will be one of the first plants of its kind in the country, inasmuch as the current will be transmitted from one plant to a number of others, instead of each mine having its own isolated plant. The new plan is said to save considerable in the cost of operation and maintenance. The railway department of the Electric Company also received an order for six motor-generator sets of 850 hp each, and transformers, from the Pacific Railway Company, which is constructing an electric railway in the suburbs of Los Angeles. The turbine department of the Machine Company and the railway department of the Electric Company also obtained a contract from the Washington, Alexandria & Mt. Vernon Railroad for powerhouse and rolling stock equipment, including one 2000-hp steam turbine.

ELECTRICAL TRADE IMPROVING IN SOUTH AMERICA.—Mr. J. K. Robinson who represents the Westinghouse Electric and Westinghouse Machine companies in Chili, Bolivia, Peru and Ecuador, reports that the serious financial depression which has prevailed in those countries during the last few months shows sign of betterment, and that the sentiment has vastly improved among trade interests. The currency, especially in Chili, is still way down, but the general trend of feeling is optimistic, and preparations are being made with a view to resuming work on a number of large enterprises, which was stopped on account of the panic. He reports, among other recent orders, from South America, a contract for a central station equipment for a town in Chili, consisting of a 1000-hp bituminous, pressure, gas producer plant, to be supplied by R. D. Wood & Company, with a 500-hp, 4-cycle, vertical gas-producer engine, direct-connected to a 350-kw, alternating-current generator, and a direct-connected exciter, to be furnished by the British Westinghouse Manufacturing Company, Ltd. The equipment includes a 17-panel central-station switchboard and necessary cranes, which will be furnished by the Westinghouse Electric Company, of Pittsburg. Shipments are being made to a large nitrate plant in Chili of two electric hoists, Lidgerwood make, four entirely enclosed 40-hp Westinghouse motors, two 85-kw generators and 20 electrical motors of various sizes. Also a central-station switchboard and apparatus, four motor-driven centrifugal and four motor-driven triplex pumps from the Gould Manufacturing Company. To another nitrate plant are being shipped one motor-generator set and a complete lighting installation. The British Westinghouse Electric & Manufacturing Company has obtained a contract for the equipment of a power plant, consisting of two 120-kw, three-phase, alternating current generators, a central-station switchboard and numerous motors.

LAST YEAR'S TURBINE BUSINESS.—Retrospective of the development during the past years of the steam turbine, the accompanying figures reported by the Westinghouse Machine Company are interesting as tending to controvert the general impression that the turbine business suffered heavily during the year. Although one month's business in 1906 still holds the record at 62,100 kw, the year 1907 was marked by an average demand quite as large. As late as July, orders for 34,750 kw were taken during that month as compared with 25,750 for July, 1906. For the first nine months of each year the demand for turbines was, in 1907, 158,550 kw, and in 1906, 152,400 kw; or, taking the middle six months of the year, from April to September inclusive, thus excluding the usual mid-winter activity as well as the late depression, the average per month is as follows: 1907, 15,833 kw; 1906, 14,365 kw. Thus it is apparent that up to the period immediately preceding the depression of October the demand for turbine equipment showed a steady increase. It is interesting to note in this connection the ultimate results of commercial activity of the past few years. Had the business of the company kept on increasing at the same rate as prevailed during 1904 and 1906, the year 1910 would have been marked by an annual output of 1,912,000 kw, or the rate of 160,000 kw per month.

LARGE ORDER FOR CURLING IRONS.—The Vulcan Electric Heating Company, Chicago, informs us that it has just taken an order for 72,000 electric curling irons, to be delivered at the rate of 3600 per month until the order is filled. The name of the purchaser is not made public, but it was stated that an extensive advertising and selling campaign will be carried out by the purchaser, and it is expected the irons will easily be disposed of. This is probably the largest single order for electric heating appliances ever placed.

PERFORATED POSTAGE STAMPS.—The Postmaster-General has issued an order permitting the perforation of postage and special delivery stamps, as a means of identification to prevent theft. The Merchants' Association of New York has issued a bulletin, showing how practical advantage may be taken of the new ruling, and gives a list, with prices, of perforators adapted to the purpose.

Financial Intelligence.

THE WEEK IN WALL STREET.—Openly professional, and based on the future rather than on present conditions, the market continued on its upward course last week, reaching the highest levels since the panic, and recording on Friday the largest amount of business transacted since the beginning of the year. The number of shares which changed hands on that day was 1,212,000. The activity of the market has been fairly well distributed along the list, the average increase in security values since Jan. 1 being more than $20 a share. There was surprisingly little in the week's news to justify the advances, and the decrease in export and import trade, the falling off in railway earnings, and the dull condition of trade would seem to justify a bear rather than a bull market. But the feeling on the Street prevailed that it was impossible for things to get any worse, and therefore the only alternative was an upward movement. The bond market during the last few weeks has been exceedingly active, the total amount of sales since Jan. 1 being $349,800,000, as compared with $201,900,000 for the same period in 1907, and it is estimated that by July 1 the sales of bonds for the first six months of the current year will be double the total amount of bond sales for 1907, besides establishing a record over any other year in the history of the Exchange. During the week $8,000,000 more gold was engaged for foreign exportation, making a total of $25,000,000 exported, but money continues to accumulate, and foreign shipments, and the likelihood of immediate withdrawals on the part of the Government are viewed without alarm. The market of Monday, this week, saw another excited rise in prices, with sales of more than a million shares and with the interest centering in leading railroad securities. There was little news that could be used as a basis for a further bull movement, and the general public figured very little in the buying, most of it being done by those of a speculative turn and by the agents of those who have been engineering the upward movement. Closing prices were as follows:

NEW YORK.

	May 11.	May 18.	Shares sold.		May 11.	May 18.	Shares sold.
All-Ch.	8	9⅜	4,215	Int.-Met., com..	11⅛	12⅝	29,155
All-Ch., pfd....	21½	25⅛	6,125	Int.-Met., pfd...	31⅜	32	39,845
Amal. Cop.....	63⅞	69⅜	395,085	Mackay Cos....	63	64½	730
Am. D. T.....	39*	39*	———	Mackay Cos., pfd	64	66¼	900
Am. Loc.....	50½	51⅛	19,480	Met. St. Ry....	29	25	200
Am. Loc., pfd..102		103½	300	N.Y. & N.J. Tel.	105*	105	———
Am. Tel. & C'bl.	50*	60	———	Steel, com.....	37⅛	39⅛	466,415
Am. T. & T....117½		117¾	1,450	Steel, pfd.....	102⅛	103¼	36,940
B. R. T.....	50¾	52⅛	140,205	W. U. T.....	51¼	585⅛	5,815
Gen. Elec.....137		140	3,340	West'h, com....	47	53¼	18,764
Hud. R. Tel....	—	—	———	West'h, pfd....	60	70	1,100

PHILADELPHIA.

	May 11.	May 18.	Shares sold.		May 11.	May 18.	Shares sold.
Am. Rys.....	44⅜	44¼	———	Phila. Elec.....	8¾	8⅞	———
Elec. Co. of Am.	10	9⅞	———	Phila. R. T.....	18¼	16⅜	———
Elec. Stor. B'ty.	32¼	32	———	Phila. Traction.	91	92	———
E. S. B'ty, pfd.	—	—	———				

CHICAGO.

	May 11.	May 18.	Shares sold.		May 11.	May 18.	Shares sold.
Chicago City Ry.	160	160	———	Met. Elev., com.	19	17	———
Com. Edison....	91¾	94¼	———	Met. Elev., pfd.	49	54	———
Chicago Subw'y	—	19⅞	———	National Carbon.	61¼	62⅛	———
Chicago Tel. Co.	118¾	122½	———	Nat. Carbon, pfd.	107½	110	———

BOSTON.

	May 11.	May 18.	Shares sold.		May 11.	May 18.	Shares sold.
Am. Tel & Tel.	117½	118	———	Mass. E. R., pfd.	44	43	———
Comb'ind Tel...	109¾	—	———	Mex. Tel., pfd..	—	—	———
Edison El. Ill...	214	214	———	New Eng. Tel'p.	113¾	113½	———
Gen. Elec.....	137½	140⅛	———	W'st Tel. & Tel.	6¼	6⅛	———
Mass. Elec. Ry.	9¾	10	———	W. T. & T., pfd.	65½	65½	———

*Last price quoted.
Shares sold are for week May 4-9.

WESTINGHOUSE REORGANIZATION COMMITTEES.—Of the 3800 stockholders of the Westinghouse Electric & Manufacturing Company, more than 1200 have responded to the request to subscribe to the new stock, and more than $1,000,000 has already been raised. Of the $10,000,000 required it is assured that $4,000,000 will be cared for by the Merchandise Creditors' Committee, between two and three millions by the Security Investment Company, $1,000,000 has been raised among the stockholders, leaving only $2,000,000 necessary for the successful conclusion of the plan. A circular issued by the Merchandise Creditors' Committee to the stockholders, dated May 15, says in part: "Under the plan advanced by the Merchandise Creditors, the Merchandise Creditors show their confidence in the future of your company by abandoning their position as your creditors and becoming your partners. This should be especially valuable to the future of the company, as there are some 1,500 Merchandise Creditors in all—an influential host of friends and workers. The Merchandise Creditors have responded promptly to the call of their committee, as those having claims amounting to $3,600,000 out of a total of $4,250,000 have already signed our agreement. A large proportion of the remainder is already promised, and we believe that practically the entire amount will join the plan. The Merchandise Creditors are willing to support this plan because they believe that, under such a readjustment of the company's affairs as it contemplates, the stock of your company will reach par, or better, within the next two years, and thus enable them to realize the full amount of their claims. If this supposition on their part be correct, it must certainly follow that your interests will be fully protected and conserved. We believe that the combined support of the creditors and the stockholders, together with the assured careful and conservative management of the business and all its varied interests (in which all classes of creditors will be strongly represented), will result in eventually making the stock of the company more valuable than it has ever been. On the other hand, if the $6,000,000 of new capital which the stockholders are called upon to raise is not subscribed, we see no alternative other than a sale of the company's assets on foreclosure. We trust you will do your part; otherwise the effort of this committee and that of all the creditors of your company will have been of no avail. Inasmuch as the time granted by the readjustment committee for securing the necessary subscriptions for new stock is rapidly passing, we trust that you will not delay in sending in your subscription to your committee in response to the urgent request which you have received from it, as by so doing you will make it possible for the Merchandise Creditors and all other creditors to join you in a plan of reorganization which should insure your company's becoming strong, successful and profitable. In order to give the stockholders every possible chance to preserve their equity, the company, with the approval of the various reorganization committees and receivers, has commissioned its salesmen at the various branch offices throughout the country, to make personal calls upon the stockholders. At present there are 18 or 20 representatives from the Boston office devoting their time to seeing New England stockholders who have not already subscribed to their portion of the stock."

BRITISH WESTINGHOUSE.—At the annual meeting of the British Westinghouse Electric & Manufacturing Company, the chairman said: "With a 2 per cent lower payroll, more than 10 per cent additional value of apparatus was produced in 1907. Percentage of cost of selling to amount of orders booked was less than in 1906, and the total increase of shipments was about 17 per cent. Export business showed considerable increase. Orders show a gain of more than 30 per cent over the preceding year. Competition is more severe than ever, and prices have been on a descending scale notwithstanding high raw materials. At the moment trade is slack, with little prospect of revival until after the summer. The company is meeting the situation by efforts to increase the volume of business and effect operating economies." For the calendar year 1907 the company reports trading profits of $461,915, from which are to be deducted charges of $405,255, leaving a balance of $56,660. Indebtedness to the American companies has been liquidated by transfer of shares in the Traction & Power Securities Company and the company has lately issued $1,250,000 out of $1,500,000 6 per cent debentures authorized.

AMERICAN LIGHT & TRACTION COMPANY.—For the quarter ended March 31 the American Light & Traction Company, of New Jersey, reports gross earnings of $659,093, an increase of $31,079 over the first quarter of 1907, and expenses of $12,000, leaving net earnings of $647,093, an increase of $31,079 over the same period in the previous year. Preferred dividends of $213,543 and common dividends of $101,410 were paid, leaving a surplus of $332,140, representing an increase of $14,177 over the surplus for the same period in 1907. The total surplus was $155,640.

KEYSTONE TELEPHONE COMPANY.—The Keystone Telephone Company, of Philadelphia, combined companies, reports for March gross earnings of $89,153, an increase of $3,758 over March, 1907, and a net of $44,661, an increase of $1,125 over the same month in the previous year. The gross for the nine months ended March 31 was $787,975 and the net $373,840, an increase of $32,224 over the corresponding nine months of the previous year.

WESTERN POWER PLANT RUMOR UNCONFIRMED.—The report that several large light and power companies doing business in the State of Colorado are contemplating a merger, and that representatives in New York are holding meetings with that end in view, found no confirmation in this city. The companies said to be interested in the alleged merger are the Denver Gas & Electric Company, the Northern Colorado Power Company, the Central Colorado Power Company, the Summit Power Company, and the Eastern Colorado Power Company. "While there are several companies concerned in these deals," the report states, "there is considered in reality only three interests, the General Electric Company, the Westinghouse Company and the McMillan syndicate. There are several auxiliary corporations of the Central Colorado Power Company existing in the State which have obtained options on practically all of the feasible sites in the State." All three of the interests named denied that there was any truth in the rumor. Mr. Henry L. Doherty, who holds a controlling interest in the Northern Colorado Power Company and the Central Colorado Power Company, stated that as far as these two companies were concerned, the report was groundless, and that no steps had been taken or considered with a view to such a merger. "This report is by no means new," said a representative of the General Electric Company, who is thoroughly conversant with the power situation in Colorado, "and probably originates with a certain person who lives out in Denver and who holds a large block of the stock in one of the companies mentioned. Whenever he wishes to dispose of a slice of his holdings, he gives an interesting merger story to the newspapers. Then, when the stock jumps a few points on the strength of the report, he sells on the bulge and settles back to plan for another coup."

MINORITY STOCKHOLDERS BLOCK PACIFIC GAS & ELECTRIC NEW BOND ISSUE.—Less than 10 per cent of the holders of the $4,500,000, 6-per cent serial debenture bonds, of the Pacific Gas & Electric Company, a $30,000,000 corporation controlling the California Gas & Electric Corporation, have halted, through the aid of the courts, the plan of the company to exchange its debenture bonds for a like issue of 30-year mortgage bonds. The Industrial & General Trust Company, Ltd., and other plaintiffs obtained from Justice Dowling, in the Supreme Court, an ex-parte injunction restraining the Pacific Gas & Electric Company, the Trust Company of America, Frank A. Vanderlip and others, from carrying out the exchange plan. The court also restrained the Trust Company of America from exchanging the deposited debentures or any receipt for them for the mortgage bonds of the Pacific Gas & Electric Company. A motion to vacate the injunction was argued before Justice Greenbaum, sitting in the Supreme Court, New York, on May 4, but the answer has not yet been filed by the justice. It was said at the office of N. W. Halsey & Company, who are interested in the financing of the company, that the exchange plan had been approved by 90 per cent of the debenture holders, and that the opposition was almost entirely on the part of foreign bondholders. "It only remains to be seen," said an officer of the company, "whether less than 10 per cent can successfully oppose the wishes of 90 per cent, which is not at all likely."

MEETINGS AND DIVIDENDS.—The directors of the Philadelphia Electric Company have declared the regular semi-annual dividend of 2½ per cent. The regular quarterly dividend of 2 per cent has been declared by the directors of the Kings County Electric Light & Power Company. The American Telegraph & Cable Company's 5 per cent dividend, guaranteed by the Western Union Telegraph Company, will be paid upon maturity on June 1. The directors of the Laclede Gas Light Company have declared the regular quarterly dividend of 1¼ per cent on the common stock, and the regular semi-annual dividend of 2½ per cent on the preferred stock, both payable June 15. The Kansas City Railway & Light Company has declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable June 1.

MONTREAL STREET RAILWAY.—Although the gross earnings of the Montreal Street Railway Company for the month of March were $288,674, an increase of $17,086 over the corresponding month in 1907, the expenses of $202,390 showed an increase of $16,929 over the same month in the preceding year, making a March net for 1908 of $86,284, an increase of only $157 over the March net in 1907. The interest, rent, etc., reduced the March surplus to $34,027, a decrease from the surplus of the corresponding period last year of $8,888. The gross for the six months (Oct. 1 to March 31) was $1,747,137, expenses $1,145,866, and net $601,171. Interest, rent, etc., $272,282, leave a surplus for the six months of $328,989, as compared with a six-months surplus in 1907 of $286,513.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—The report of the American Telephone & Telegraph Company, including all the associated Bell Telephone operating companies, not including long-distance lines, for the month of March gives a telephone revenue of $9,790,100; operating and maintenance expenses of $7,229,700, leaving a balance for dividends of $2,296,200. The total net earnings from Jan. 1 to March 31, 1908, were $8,650,400, an increase of $926,200 over the same period in 1907. Charges of $1,973,600 were an increase of $285,300 over the same period last year, leaving a balance for dividends for the quarter of $6,676,800, an increase of $640,900 for the first three months in 1907.

UNION ELECTRIC BONDS SOLD.—Announcement is made by N. W. Harris & Company that the entire $2,500,000 bonds of the Union Electric Light & Power Company, of St. Louis, have been sold. The proceeds from this bond issue will enable the North American Company to clear off the remainder of its floating debt, and will place its finances in a strong position. The prospect of a resumption of dividends by the company is regarded as improved materially by this transaction, and it was said by one in close touch with the affairs of the company that the directors are likely to order the resumption of dividends within a few months.

INTERBOROUGH NOTES FIND READY MARKET.—Without putting up a single dollar, the syndicate formed by J. P. Morgan & Company to underwrite the $25,000,000 three-year, 6 per cent note issue of the Interborough Rapid Transit Company made one of the quickest profits ever realized in a similar undertaking in Wall Street. The participants of the syndicate realized about 2¾ per cent, 2 per cent was allowed to the bankers for the formation and management of the syndicate, which brought the total commission paid by the Interborough Company, including expenses, up to 5 per cent, or $1,250,000 on the $25,000,000 issue.

UTICA GAS & ELECTRIC COMPANY.—For the year ended Dec. 31, 1907, the Utica Gas & Electric Company reports gas sales of $290,308, electric sales of $476,797, making a total of $767,105, an increase of $67,949 over 1906. Total operating expenses were $373,133, an increase of $66,763 over 1906, and the total net earnings $399,595, an increase of $2,382. Interest charges of $219,500, including interest on refunding extension 5-per cent bonds, were an increase of $80,078 over 1906, leaving a surplus of $180,095, less than the surplus for 1906 by $77,696.

GENERAL ELECTRIC DIRECTORS CHOSEN.—At the annual election of the General Electric Company the following named directors were elected: Gordon Abbott, Oliver Ames, C. A. Coffin, W. H. Crane, T. J. Coolidge, Jr., B. E. Sunny, George P. Gardiner, Henry L. Higginson, J. P. Morgan, J. P. Ord, Robert Treat Paine, 2d, Marsden J. Perry, E. W. Rice, Jr., Charles Steele and S. L. Schoonmaker. The above were all re-elected with the exception of B. E. Sunny, of Chicago, who succeeds Frederick P. Fish, resigned.

INTERNATIONAL RAILWAY COMPANY.—A report of the International Railway System of Buffalo for the quarter ended March 31, 1908, shows gross earnings of $987,631, expenses of $660,262 and a net income of $327,368, with a total income of $343,226, as compared with the total income of the corresponding quarter last year of $345,655. Deducting charges of $282,430, gives a surplus of $60,796, a decrease from $96,798, the surplus for the same quarter last year.

CHICAGO TELEPHONE COMPANY CHANGES.—Mr. John M. Clark has resigned as chairman of the Chicago Telephone Company board of directors, President Wheeler succeeding him, and Mr. B. E. Sunny has succeeded Mr. Arthur D. Wheeler as president. Mr. Clark continues as a director. Mr. Sunny was formerly connected with the Chicago Telephone Company, and for some years has been a vice-president of the General Electric Company.

GEORGIA RAILWAY & ELECTRIC COMPANY.—The report for March of the Georgia Railway & Electric Company shows a gross of $281,074, as compared with $274,783 for the same month in 1907, an increase of $6,290. The net earnings were $141,832, as compared with a net of $143,416 for March in 1907, a decrease of $1,583.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

GLOBE, ARIZ.—The Globe Electric & Gas Company, which has been reorganized, is planning to make improvements to both the gas and electric departments, which will involve an expenditure of about $150,000.

BERKELEY, CAL.—The Pacific Gas & Electric Company, of San Francisco, has applied for a permit to construct a substation, the cost of which is estimated at $12,000.

ESCONDIDO, CAL.—The Escondido Mutual Water Company is contemplating utilizing the water power from its reservoir to generate electricity. It is proposed to locate the plant below the dam, where a fall of about 450 ft. can be obtained.

EUREKA, CAL.—At the annual meeting of the Humboldt Water & Power Company permanent organization was effected and the following officers were elected: N. H. Falk, president; J. N. Lentell, vice-president; R. L. Boehne, secretary; Bank of Eureka, treasurer. Water will be carried from Mad River, and 15,000 inches have been claimed by the company for the purpose of supplying this city. The proposed system is to be a combination of water supply and water power.

LONE PINE, CAL.—The Four Metals Mining Company is making preparations to construct an electric power plant at the foot of the Sierras as soon as a permit can be obtained from the Forest Service.

MARTINEZ, CAL.—The Board of Supervisors of Contra Costa County has granted A. W. Maltby and Joseph Napthaly permission to construct and operate an electric railway through the Alameda and Contra Costa County tunnel.

PASADENA, CAL.—Contracts have been awarded by the City Council for equipment for the electric light plant as follows: To the California Electric Company, of Los Angeles, for 15,800 lb. No. 6 triple braid weatherproof drawn copper wire, for $2,464; to J. B. F. Kieruiff, Jr., & Company, of Los Angeles, for poles, cross arms and braces, for $5,843. Herman Dyer is city clerk.

REDDING, CAL.—The Northern Light & Power Company expects to deliver electricity for lamps and motors in Redding before the end of the year. The power house on South Cow Creek, 25 miles east of Redding, is ready for the machinery, orders for which have already been placed. The pipe line will be 3600 ft. long and will deliver water under a 715-ft. pressure.

SONORA, CAL.—The Stanislaus Electric Power Company has filed a notice of an appropriation of 8000 cu. inches of water of the Middle Fork, of Stanislaus River, at a point above McDonnell's Flat.

TURLOCK, CAL.—T. J. Burrow, Jr., of Amador, has applied to the City Trustees for a franchise to erect transmission lines in the city of Turlock.

TELLURIDE, COL.—The Telluride Power Company has filed with the County Recorder a mortgage of $10,000,000, in favor of the Citizens' Saving & Trust Company, of Cleveland, Ohio, covering an issue of six per cent bonds, secured by rights, plants and franchises in Colorado, Utah and Idaho. Of the above issue, $2,500,000 will be used to redeem outstanding bonds and take up floating indebtedness, and the remainder will be used for further development of the company's business.

EAST NORWALK, CONN.—The contract for installing the new electric lighting system has been awarded by the lighting committee to W. M. Sheehan & Company, for $5,150.

NEWARK, DEL.—The Elk River Heat, Light & Power Company, which is building a large power plant on the Elk River, three miles from Newark, has its plant nearly completed and will soon put it in operation. The company proposes to furnish electricity for lamps in Newark, Kembleville, Oxford and West Grove, and will also furnish electricity to farmers for motors to operate small machinery.

SEAFORD, DEL.—Madison Willin contemplates installing a dynamo in his plant to furnish electricity for from 500 to 1000 lamps of 16 cp, in connection with a water-power plant already installed.

WASHINGTON, D. C.—Bids will be received until May 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Mare Island, Cal., schedule 1154—electrical supplies, etc. Charleston, S. C., schedule 1176—universal cable saw bench, motor driven fan and condenser outfit. Bids will be received until June 2 as follows: Boston, Mass., schedule 1206—two electric motors. Also until June 9 as follows: Mare Island, Cal., schedule 1191—batteries, wireless material, 10 portable ammeters. Applications for proposals should designate the schedules desired by number. E. B. Rogers is paymaster general, U. S. N.

LUDOWICI, GA.—The city is considering the proposition of establishing an electric light plant.

ST. MARIES, IDAHO.—Poles are being erected for the electric lighting system to be installed in this town. As yet the location of the power plant has not been decided upon. It is expected to have the plant completed and in operation by next fall.

ALBION, ILL.—Fred L. Hisgen, of Evansville, Ind., has applied for a franchise to erect an electric light plant in Albion.

CHICAGO, ILL.—The South Shore Gas & Electric Company, of Hammond and surrounding towns, is negotiating with the Sanitary District Board of Chicago to obtain electrical energy from the drainage canal plant near Lockport to furnish electricity for motors in Hammond and vicinity.

CHICAGO, ILL.—It is reported that the Cosmopolitan Electric Company has submitted a proposition to the Trustees of the Sanitary District of Chicago offering to take all the electrical energy that it now produces or will produce in the future at the rate of $21 per horse-power per year. Roger Sullivan is secretary of the company.

CONCORD, ILL.—Plans are being considered by the Chicago, Burlington & Quincy Railroad Company to install a complete telephone system on its line from Concord to Herring.

GALESBURG, ILL.—The Galesburg Union Telephone Company will soon commence work on the extension of its system, which will include the erection of a telephone line from Galesburg to Yates City and also to Kewanee, Monmouth, Macomb, Rock Island and Watertown.

GENESEO, ILL.—The Concrete Engineering Company, of Martins Ferry, Ohio, has been awarded the contract for erecting the power house of the Geneseo Electric Light Company. The old building was destroyed by fire several weeks ago.

HARMON, ILL.—The Green River Telephone Company contemplates making many extensions to its system.

MASCOUTAH, ILL.—The Looking Glass Prairie Telephone Company expects to extend its lines from this city to Turkey Hill.

NORTH CHICAGO, ILL.—The contract for the equipment of the electrical power plant at the Great Lakes naval station has been awarded to the D'Olier Engineering Company, of Philadelphia, Pa., for $126,550.

COLUMBUS, IND.—The Central Indiana Lighting Company contemplates extensive improvements to its plant, including the construction of a new power plant and improvements to its street railway system. As yet nothing definite has been decided.

INDIANA HARBOR, IND.—The C. H. Geist Company, a gas and electric corporation, of Chicago, Ill., has purchased the electric plant formerly owned and operated by the city of East Chicago, Ind. The company will in the future be known as the Indiana Harbor & East Chicago Electric Company. The officers of the company are: C. H. Geist, president; C. H. Weak, vice-president, and C. W. Fox, secretary and treasurer.

LANESVILLE, IND.—The Harrison County Telephone Company is planning to build an additional telephone line between this city and Corydon to take care of its increasing business.

IOWA CITY, IA.—The Iowa Telephone Company has been granted permission to rebuild its system in this city.

KEOKUK, IA.—Hugh L. Cooper, of New York, N. Y., representing the Keokuk & Hamilton Water Power Company, has applied to the City Council for a franchise to furnish electricity in this city and to operate an electric railway. The company proposes to erect a dam on the Des Moines River and transmit electricity to cities in Iowa, Illinois and Missouri.

FRANKFORT, KY.—Plans will be prepared and submitted to the Capitol Commission by Prof. Paul Anderson and L. K. Frankel, of the State University, Lexington, Ky., for a power house and installation of plant to furnish electricity for lighting, heating, etc., for the new capitol. An appropriation of $460,000 has been made for completing and furnishing the building.

HALL, KY.—The Upper Rockhouse & Beaver Creek Telephone Company has commenced work on the construction of its telephone line from Hall to Colson, Ky., a distance of about 18 miles, and is also planning to build a number of short lines. The company is in the market for equipment and construction material.

PADUCAH, KY.—The Paducah & Cairo Interurban Company has been granted a franchise in this city. The interurban line will extend from Paducah to East Cairo, Ky., where a ferry boat will be operated to Cairo.

SERGENT, KY.—The Letcher County Home Telephone Company will construct a telephone line from the Kentucky River to Margaret, and also a line between Whitesburg, via Mayling to Thornton.

AMITE CITY, LA.—The plant of the Central Light & Power Company was nearly destroyed by the tornado. It is said that the company will not rebuild the plant unless the city will guarantee it $150 per month. It is expected that the City Council will agree to the guarantee.

TURNER, MAINE.—The East Hebron Telephone Company, which has been granted a franchise in this city, contemplates extending its telephone lines in Turner, Hebron and Minot.

FREDERICK, MD.—The Washington, Frederick & Gettysburg Railway Company has decided to proceed immediately with the extension of its line from Lewiston to Catocin Furnace, to connect with the Monocacy Valley Railroad to Thurmont, which the company recently purchased. The extension will be about three miles in length.

BOSTON, MASS.—The Senate has passed the bill removing the limit of capital stock, which may be issued by gas and electric companies. Under the present law the capital stock of companies is limited to $1,000,000. Under the new law the capital stock may be increased to such amounts as may be authorized by the State Board of Gas and Electric Light Commissioners.

GRANITEVILLE, MASS.—The citizens are considering the question of lighting the streets of the town.

NORTH EASTON, MASS.—A committee has been appointed to look into the question of establishing an electric light plant and report at the next annual meeting. The street lighting contract expires next year.

MONROE, MICH.—The Toledo, Ottawa Beach & Northern Railway Company has notified the City Council that it will apply for a franchise through the city. The railway will be extended from Monroe to Detroit.

PORT HURON, MICH.—It is reported that the Michigan United Railways has made arrangements for a bond issue of several million dollars to provide funds for the completion of the Lansing-Jackson interurban railway and the building of a road from Kalamazoo to Benton Harbor, and extensions of the street railway systems in Lansing, Battle Creek and Kalamazoo. Sanford W. Ladd is counsel for the company.

BEMIDJI, MINN.—The Northwestern Telephone Company contemplates making extensive improvements and extensions to its system in this city.

BRECKENRIDGE, MINN.—The Wilkin County Telephone Company is planning to erect about 20 miles of rural telephone lines.

BUHL, MINN.—Plans are being considered for improvements and changes in the municipal electric light and water plant. Oscar Clausen, of St. Paul, is engineer.

SAVANNA, MINN.—The Chicago, Milwaukee & St. Paul Railway Company has decided to install a telephone system between Savanna and Chicago.

CARROLLTON, MISS.—The Carrollton Electric Light Company has decided to rebuild its plant, which was destroyed by fire about a year ago. The company will dispose of the old machinery and install new equipment throughout.

NATCHEZ, MISS.—The Southern Light & Traction Company contemplates extending its lines to the National Cemetery and to Washington.

VICKSBURG, MISS.—The plant and holdings of the Vicksburg Street Railway & Lighting Company has been purchased by the Bullis Company, and will be reorganized under the name of the Vicksburg Power Company. S. S. Bullis is president of the Bullis Company.

CHILLICOTHE, MO.—A new telephone system will be installed by the Mutual Telephone Company, recently organized, in this city to connect with other mutual companies in the county.

NEVADA, MO.—The Missouri Light & Traction Company has awarded the contract for all improvements to be made to its property to the Freeborn Engineering & Construction Company, of Kansas City, Mo.

RICHMOND, MO.—The Richmond Electric Light Company has submitted a proposition to the City Council offering to sell its entire plant and holdings to the city for $18,000. The Council had authorized the Mayor to appoint a committee to make investigations in regard to the value of the plant and its purchase by the city.

GREELEY, NEB.—Extensive improvements are to be made to the local system of the Greeley Telephone Company, which was recently purchased by E. D. Gould, of Kearney, and others. The new owners expect to construct a number of new lines.

SEWARD, NEB.—Bids will be received until June 3 at the office of the city clerk for furnishing labor, material and apparatus for an addition to the municipal electric light system as follows: Brick addition and foundation for machinery, Corliss engine, generator, exciter and switchboard. John Martz is engineer.

LANCASTER, N. H.—The contract for lighting the streets of the town has been awarded to Messrs. Jones & Linscott for a term of five years. The company has been furnishing a day service, but will equip its plant for a 24-hour service. A new water wheel and a 75-kw generator has recently been installed in the plant, and an entirely new street lighting system will be erected. The Lancaster & Jefferson Electric Company has provided street lamps for the town for nearly 18 years.

NEWARK, N. J.—The finance committee of the Board of Freeholders has appropriated $10,000 for the installation of a larger electric light and power plant in the penitentiary. The equipment will consist of a 150-hp boiler, an 80-hp engine and generator. An appropriation of $26,500 for the installation of an electric plant at the court house was requested, but was deferred for action later.

BROOKLYN, N. Y.—The contract for installing electrical equipment in addition to and alteration in School 24, Borough of Brooklyn, has been awarded to T. Fred Jackson, New York City, for $8,813, by C. B. J. Snyder, superintendent of schools.

GENEVA, N. Y.—The new power plant which is to be erected by the Geneva-Seneca Electric Company will be located at Border City, and will furnish electrical energy to Geneva, Seneca Falls and Waterloo. The equipment of the plant will consist of 4500-kw, three-phase, 60-cycle generators direct connected to steam turbines. The capital for the new plant will be furnished by the Electric Securities Corporation, the holding company of the Geneva-Seneca Electric Company. The cost is estimated at $150,000.

HOOSICK FALLS, N. Y.—The Schaghticoke Electric Company has awarded the contract for the construction of its power house to the Hudson Valley Construction Company, of Troy, N. Y. Viele, Blackwell & Buck, 45 Wall Street, New York City, are the consulting engineers.

NEW YORK, N. Y.—Preparations are being made to equip the Hempstead division of the Long Island Railroad to be operated by electricity.

NEW YORK, N. Y.—Bids will be received until May 25 by C. B. J. Snyder, superintendent school buildings, for installing electric equipment in new Public School No. 100, Borough of Manhattan.

SOUTHAMPTON, N. Y.—The Public Service Commission, second district, has authorized the Suffolk Light, Heat & Power Company to issue $15,000 in bonds, the proceeds to be used for extensions and improvement to its plant.

CLEVELAND, OHIO.—The contract for the 1000-kw unit for the South Brooklyn municipal electric light plant has been awarded to the Westinghouse Machine Company, of Pittsburg, Pa., for $34,725.

CLEVELAND, OHIO.—The temporary restraining order enjoining the Cuyahoga Light & Power Company from placing underground conduits on Prospect Avenue was dissolved after a motion to that effect before Judge Babcock was granted. This move was anticipated on account of the franchise given the light and power company recently.

MT. VERNON, OHIO.—Extensive improvements are contemplated by the Mt. Vernon Telephone Company, including the rebuilding of its plant at Gambier, and the reconstruction of the line between Mt. Vernon and Fredericktown. The cost of the work is estimated at about $8,000.

NORTH BALTIMORE, OHIO.—The electric light and power plant owned by Dr. A. G. Henry has been sold to the Goodloe Company, of Toledo, for $30,000.

SIDNEY, OHIO.—The Sidney Telephone Company is in the market for the following supplies: Phantom repeating coils, galvanized iron wire, insulated wire, 1000 poles, insulators, storage batteries, etc. C. R. Bleakley is manager.

SPRINGFIELD, OHIO.—The property of the Washington Traction Company was purchased by George W. Baker, of Greenfield, at a receiver's sale for $36,667. Mr. Baker states that he will extend the railway from South Charleston to Washington C. H., Jeffersonville, Hillsboro and Greenfield. The road will also be brought into this city over its own right of way and a power house will be erected.

WEST POINT, OHIO.—The power plant of the Youngstown & Ohio River Railroad located in this city has been placed in operation and is now furnishing electricity to operate the cars between West Point, Lisbon, Salem, Columbiana and Youngstown. It is said that the necessary capital to complete the road into East Liverpool will be available at an early date.

CHICKASHA, OKLA.—The Chickasha Interurban Railway Company, which has leased the property of the Oklahoma City, Lexington & Sulphur Interurban Railway Company, has been offered the following bonus to extend the railway to the following points: Sulphur, $30,000; Wynnewood, $20,000; Davis, $20,000.

EL RENO, OKLA.—The city has applied to the secretary of the Board of Agriculture for permission to construct a canal across the bend of the North Canadian River, near El Reno, for power and irrigation purposes.

OREGON CITY, ORE.—Plans are being considered for the construction of an electric railway from Oregon City to the coal and cement fields in the eastern part of the county. F. M. Swift, of Portland, is interested in the enterprise.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until June 6, for furnishing the following supplies: Shop machines, pumps, electric motors, wire cable, steel tubing, electric marine fixtures, etc. Blanks and general information relating to this circular (No. 442) may be obtained from the office of the general purchasing officer, or the offices of the assistant purchasing agents, 24 State Street, New York City, N. Y.; Custom House, New Orleans, La.; 1086 North Point Street, San Francisco, Cal., and Chamber of Commerce Building, Tacoma, Wash.; also from the U. S. engineer offices in the following cities: Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky., and Mobile, Ala. Lieut.-Col. H. F. Hodges is general purchasing officer.

BLOOMSBURG, PA.—The United Telephone & Telegraph Company expects to construct a telephone line between this city and Cabin Run, and will also build a new line between Espy and Almedia.

EXCHANGE, PA.—The People's Ideal Telephone Company contemplates extending its lines from this city to Muncy.

KUTZTOWN, PA.—The Kutztown Rural Telephone Company is contemplating the extension of its system to Eagle Point, Mill Creek Valley and New Smithsville.

MILLERSBURG, PA.—Plans are being considered by the Farmers' & Merchants' Rural Telephone Company to construct a new telephone line from this city to Freytown and thence to Crosskill Mills, Hamlin, Mount Aetna and Myerstown.

MONTOURSVILLE, PA.—The Montoursville Passenger Railway Company has increased its indebtedness from $75,000 to $150,000.

WEST CHESTER, PA.—The West Chester & Wilmington Street Railway Company has awarded the contract for the construction of its entire

railway between Wilmington, Del., and West Chester, Pa., to the Eastern Construction Company. The line will be about 16 miles long.

YORK, PA.—Plans are contemplated by the York Haven Water & Power Company for extensive improvements to its plant, which will increase the output of the plant at York Haven from 10,000 to 20,000 hp. The plans call for the construction of an addition to the power house 280 ft. in length, 10 General Electric generators and 20 water wheels, manufactured by the Poole Engineering & Machine Company, of Baltimore, Md. An electric crusher will be installed at the quarries. The company also proposes to extend its high-tension transmission lines to Lancaster and other cities in the lower part of Lancaster County, and to Spring Grove and Hanover. E. F. Baker is general manager of the company.

ALBION, R. I.—The Town Council is considering a proposition submitted by the Albion Light & Power Company to furnish electricity for lighting the town. The company proposes to furnish electrical energy to light the mill and tenement houses of the Valley Falls Company. The present charter of the company only permits it to operate within a radius of one mile. If the charter is amended, it is said that the price for electric lamps furnished the town will be greatly reduced.

ABBEVILLE, S. C.—The city is considering the question of issuing $25,000 in bonds to purchase and improve the plant of the Abbeville Light & Power Company. J. L. McMillan is mayor.

PARKSVILLE, S. C.—The Twin City Power Company contemplates the construction of a large power plant on the Savannah River near Parksville.

CANOVA, S. D.—Proposals will be received by W. T. Gough, secretary of the Vermilion Telephone Company for material for construction of 13 miles of telephone line.

AUSTIN, TEX.—The Water and Light Commission has adopted plans for rebuilding the dam across the Colorado River here, at a cost estimated at $750,000. F. M. Maddox is Mayor.

PARK CITY, UTAH.—Among the new construction work contemplated by the Independent Telephone Company of this city is the erection of new telephone lines between Park City, Kamas and Heber.

BRATTLEBORO, VT.—The citizens have voted to authorize the Board of Bailiffs to take the necessary steps to procure from the next State Legislature permission for the Village of Brattleboro to purchase or construct a municipal lighting plant.

PETERSBURG, VA.—Plans are being made by the Dinwiddie County Telephone Company for several extensions to its lines.

RICHMOND, VA.—The receivers of the Richmond Passenger & Power Company have agreed to extend its transmission lines to Highland Park, a newly incorporated town north of this city, if enough patrons can be secured to pay the company for the cost of the work.

HARRINGTON, WASH.—The Big Bend Electric Light Company has purchased the Harrington electric light plant, formerly owned by William Brodie. The price paid for the plant was $15,000. The new company will take possession of the plant June 1.

LIND, WASH.—The Big Bend Light & Power Company has applied to the Council for a 30-year franchise to operate a water and light plant in this place.

SEATTLE, WASH.—Plans have been prepared by L. B. Youngs, superintendent of the Water and Lighting Department, for a substation to be erected in West Seattle, at a cost of $10,000.

TACOMA, WASH.—The special water committee on May 1 decided to recommend to the City Council that the Commissioner of Public Works purchase immediately an air compressor of at least 150 hp, with necessary motors and other equipment, and that plans be prepared for a building for the machinery; also that data be secured relative to the size of pipe required to replace the section of the Clover Creek flume now used to carry the well water to the pump house.

VANCOUVER, WASH.—Franchises have been secured by the Washougal-Sunnyside Telephone Company and the Ridgefield-Sara & Vancouver Farmers' Union Telephone Company to erect their lines over and across certain roads in Clarke County.

MILLVILLE, W. VA.—The Winchester & Washington City Railway Company has placed contracts for equipment for its plant as follows: To the Dayton Globe Iron Works Company, of Dayton, Ohio, for two pair of turbine wheels, with a rating of 1000 hp each; to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., for generators of 500 kw each.

BRUCE, WIS.—Plans are being prepared by Oscar Clausen, of St. Paul, Minn., for an electric light and water plant.

CASHMERE, WIS.—The Valley Power Company is contemplating installing a water and power plant in Cashmere, and proposes to furnish electricity to light the city and to operate the pumping plant at $40 per horse-power per year. About 50 hp will be needed.

CUMBERLAND, WIS.—The Common Council has decided to call a special election to vote on the proposition to issue $25,000 in bonds, the proceeds to be used to improve the electric light plant and to build a city hall.

MADISON, WIS.—The contract for the construction of the building for the separate heating, lighting and power plant for the new State Capitol has been awarded by the Capitol Commission to T. C. McCarthy, of Madison, for $108,000. The contract for the smokestack, which will be 200 ft. high, will be let soon.

WAUPUN, WIS.—The State Board of Control has awarded the contract for the power plant for the state prison to the Rathbun-Jones Engineering Company, of Toledo, Ohio, for $25,600.

CHEYENNE, WYO.—It is reported that Daniel Hewitt, of Colorado Springs, Col., president of the Interstate & Improvement Company, and S. G. Griffin will make application to the City Council for a franchise to operate an electric light and street railway system in this city. It is proposed to construct an electric railway through Cheyenne to Fort Russell, a distance of 5 miles. The cost of the proposed system is estimated at $75,000.

EDMONTON, ALB., CAN.—Alfred Bowen, of San Francisco, Cal., representing capitalists of Kansas City, is negotiating for the purchase of the partially completed electric street railway system.

EDMONTON, ALB., CAN.—City Engineer Keeley is making arrangements for the immediate construction of the civic power plant at a cost of $140,000.

LADYSMITH, B. C., CAN.—The ratepayers voted in favor of the installation of an electric lighting system. For further information address Mayor Nicholson.

NELSON, B. C., CAN.—The municipal electric light plant and the substation of the West Kootenay Power & Light Company were destroyed by fire, causing a loss of about $50,000. The plant of the Electric Tramway, leased by the city, was also entirely destroyed.

VICTORIA, B. C., CAN.—The British Columbia Electric Railway Company is planning to make many improvements to the local system, and will make extensions in and around the city, the cost of which is estimated at $2,000,000. The company is advertising for bids for the construction of the first section of the Chilliwack-Westminster electric railway from Westminster to Cloverdale, a distance of 12 miles.

MERRITON, ONT., CAN.—The Council has decided to install a municipal electric plant. For further information address G. B. Wilson.

PORT HOPE, ONT., CAN.—The plant of the Port Hope Electric Light & Power Company was completely destroyed by fire May 8, causing a loss of about $50,000.

FORT ERIE, ONT., CAN.—A bill has been passed in the Provincial Legislature giving the Fort Erie Ferry Railway Company permission to extend its railway along the frontier. The company proposes to build a railway from Chippawa to Port Colborne. Frank J. Weber is president of the company.

TORONTO, ONT., CAN.—Bids will be received by Adam Beck, chairmain Hydro-Electric Power Commission, until June 2, for the construction of the Toronto-Niagara Falls, St. Thomas-Niagara Falls transmission line: (a) steel transmission towers; (b) transmission line cable; (c) erection, complete, of transmission system, according to plans and specifications to be seen at the Commission's office. Tenders will not be considered unless on form supplied by the Commission.

MONTREAL, QUE., CAN.—The Saraguay Electric & Water Company has been formed for the purpose of taking over the property and holding of the Saraguay Electric Light & Power Company. A bill has passed the Quebec Legislature granting the new company very extensive powers. The territory of the new company embraces the entire Island of Montreal, including the City of Montreal, the Island of Bizard, and the counties of Two Mountains, Laval and Terrebone. The company is contemplating increasing its output by several thousand horse-power during the present year. Its present plant is located in Cartierville. The company is capitalized at $3,000,000, and the directors are W. M. Ramsay, H. Lamporte, E. Champagne, Gaspard de Serres, and Charles Brandeis, all of Montreal.

PRINCE ALBERT, SASK., CAN.—The City Council has decided to replace the present electric lamps on the streets with arc lamps, supplying electricity from its own electric plant. For further information address C. O. Davidson, clerk.

PRINCE ALBERT, SASK., CAN.—The City Council has decided not to dispose of the municipal electric lighting plant and contemplates operating a municipal street railway system with it.

SAN ANGEL, MEX.—The United States & Mexican Trust Company, agents for Colonia Altavista, have secured the right of way for a street car line from the lower plaza in San Angel to the Inn. Arrangements have been made with the Tramways Company to build the road and operate it in connection with its general system. The company has recently installed an electric pumping plant.

New Industrial Companies.

THE LACKAWANNA ELECTRIC SHOE POLISHING COMPANY has been incorporated with a capital stock of $50,000 by F. P. Christian, J. A. Judson and W. L. Shrader, of Scranton, Pa.

THE BALL-COOLEY ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 by Conrad Hubert, of New York, N. Y.; Walter Ball, of Rochester, N. Y., and John F. Cooley, of Boston, Mass.

THE INTERNATIONAL GENERATOR COMPANY, of Hoboken, N. J., has been incorporated with a capital stock of $100,000 by J. E. Whiting,

W. P. Jesup and F. C. Pringle. The company proposes to manufacture machinery, engines, motors, etc.

THE CARQUINEZ ELECTRIC & CONSTRUCTION COMPANY, of Martinez, Cal., capitalized at $20,000, has been incorporated by E. W. Jensen, Jos. Niayo, C. L. Pingree, F. C. Woolcott and M. C. Arnold.

MERRILL-RUCKGABER-FRASER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $35,000, by A. F. Ruckgaber, O. Merrill, of Brooklyn, N. Y., and C. E. Fraser, of Richmond Hill. The company proposes to do a general engineering and contracting business.

THE BENNETT-STODDARD COMPANY, of Augusta, Maine (electrical engineers), has been incorporated with a capital stock of $10,000. The officers of the company are: C. B. Stoddard, president; Irving Bennett, secretary, and C. S. Bennett, treasurer, all of Augusta, Maine.

THE GEORGE R. TRUMBULL ELECTRIC MANUFACTURING COMPANY, of Trenton, N. J., has filed articles of incorporation with a capital stock of $50,000. The company proposes to manufacture electric specialties and the incorporators are: G. R. Trumbull, N. B. Trumbull and J. H. Delp.

THE WEIDENTHAL-GOSLINER ELECTRIC WORKS, of San Francisco, Cal., has been incorporated with a capital stock of $100,000 by S. H. Weidenthal, Herbert Gosliner and S. M. Samter. The company has just taken new quarters at the corner of Mission and New Montgomery Streets, this city.

THE CAMPBELL-STAGG COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by William G. Campbell, Henry E. Moore, of New York, N. Y., and De Peyster Stagg, of Hackensack, N. J. The company proposes to manufacture mechanical and electrical devices, etc.

THE DARLEY ENGINEERING COMPANY has filed articles of incorporation with the Secretary of State at Wilmington, Del. The capital stock of the company is placed at $100,000 and the incorporators are: Harland B. Tibbetts, James G. Gregg, both of New York, N. Y., and John T. McGovern, of Brooklyn, N. Y.

THE DICTAPHONE COMPANY OF AMERICA, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000. The company proposes to manufacture and deal in phonographs, dictaphones, etc. The incorporators are: Theodore F. Mumphrey, Horace Barnard, of New York, N. Y.; Howard S. Fisher, of Greenwich, Conn.; Henry G. King, Jacob W. Binder, William H. MacGregor, of New York, N. Y., and John C. Button, of Rochelle Park.

Company Elections.

LAKEPORT, CAL.—At the annual meeting of the Sonoma & Lake County Railway Company the following-named officers were elected: A. E. Dickenson, president; J. E. Fulton, vice-president; D. F. McIntire, secretary; J. R. Garner, treasurer, and W. P. Mariner, general manager.

WATERBURY, CONN.—At the annual meeting of the Waterbury-Milldale Tramway Company the following officers were elected: Charles H. Clark, of Milldale, president; John H. Cassidy, of Waterbury, secretary, and E. S. Todd, of Southington, treasurer.

SPRINGFIELD, MO.—At the annual meeting of the Springfield Traction Company the following-named officers were elected: George E. McComber, of Augusta, Maine, president; W. A. Bixby, vice-president and general manager; N. J. Cunningham, secretary, and E. B. Lewis, of Chicago, Ill., treasurer.

New Incorporations.

ONTARIO, CAL.—Articles of incorporation have been filed for the San Bernardino Telephone & Telegraph Company, with a capital stock of $200,000. The directors of the company are: J. A. Fletcher, R. P. Carter, L. R. Kennedy, J. N. Hartley and R. L. Dunbar, all of Ontario.

SAN FRANCISCO, CAL.—The Keystone Electric Company has been incorporated with a capital stock of $10,000 by S. H. Foster, Geo. Nolan, William W. Goldnamer. A. P. Harris, attorney.

CHICAGO, ILL.—The Kenilworth Lighting Company has filed articles of incorporation with a capital stock of $25,000. The incorporators are Girard A. Ellingston, Albert V. Horn and Julius L. Hecht. The company proposes to operate a heating, light and power plant.

MONTROSE, ILL.—The Montrose Mutual Telephone Company has been incorporated, with a capital stock of $9,000, by G. B. Tope, Rueben A. Isley, Campbell J. Elliott, M. F. Wallace, T. O. James and others.

HANFORD, IA.—The Hanford Telephone Company has been chartered with a capital stock of $10,000 and the following named officers elected: H. Diercks, president; A. J. Talbred, vice-president; C. S. Hansen, secretary and treasurer.

SIOUX CITY, IA.—The Farmers' Mutual Telephone Company has been organized to take over the property of the Pierson Independent Company. The following named officers have been elected: O. L. Cole, president; J. F. Brooks, vice-president; Oscar Pixler, secretary, and J. H. Benson, treasurer.

MASON CITY, IA.—The Farmdale Telephone Company has been incorporated, with a capital stock of $10,000, and the following officers elected: G. W. Gibbs, president; D. E. Elson, secretary and treasurer.

BONNER SPRINGS, KAN.—The Wyandotte County Telephone Company has been organized, with a capital stock of $75,000. The directors are: T. S. McKinnon, of Tonganoxie; J. A. Thompson, of Edwardsville; J. D. Waters, J. D. Coon and W. S. Twist, of Bonner Springs.

DIXIE, KY.—The Dixie Telephone Company has been formed, with a capital stock of $1,000, by J. T. Walkers, David Dayler and S. K. Lewis. The company contemplates the construction of a telephone system to Hartley. About 15 miles of line will be erected and the company is in the market for construction material.

JACKMAN, MAINE.—The Jackman & West Forks Telephone Company has been incorporated with a capital stock of $10,000 by Charles L. Andrews, of Augusta; Henry P. McKenny and L. A. McKenny, of Jackman.

FORT FAIRFIELD, MAINE.—Articles of incorporation have been filed for the Fort Fairfield Light & Power Company. The company is capitalized at $21,000, and the officers are D. E. Edwards, president; H. T. Powers, treasurer and clerk, all of Fort Fairfield, Maine.

EDMORE, MICH.—The Farmers' Home Telephone Company has been organized to construct a telephone system in the Cutler and Savage districts.

OTTAWA LAKE, MICH.—The Whiteford Farmers' Telephone Company has been chartered with a capital stock of $6,000, with headquarters at Whiteford Center, post office address Ottawa Lake.

ELBOW LAKE, MINN.—The Farmers' Home Telephone Company has been organized to construct a telephone system and the following named officers have been elected: Peter Martinson, president; Elbur Felstrom, vice-president; T. Pederson, secretary, and Nels Anderson, treasurer.

FERGUS FALLS, MINN.—The French Telephone Company has been formed to construct a telephone line from Pelican River to Fergus Falls and thence to French Station.

FRUITLAND, MO.—The Farmers' Mutual Telephone Company has been formed in this city and the following named officers elected: A. P. Williams, president; W. W. Randol, vice-president: William Wessel, secretary, and Theodore Leimer, treasurer. The company proposes to establish an exchange at Pocahontas, and extend its lines to Leemon, Fruitland, Shawneetown and other points, and, ultimately, to Jackson.

CULBERTSON, MONT.—The Montana Star Telephone Company has been organized to construct a telephone system from Redstone and Plentywood to Culbertson and thence to Glasgow. Exchanges will be established at Homestead, Medicine Lake, Plentywood, Redwood and other places.

FREEHOLD, N. J.—The Freehold & East Windham Telephone Company has been incorporated, with a capital stock of $12,000 and the following directors elected: W. J. Griffin, of East Windham; Harry Phinney and R. C. Lacey, of Freehold.

BERLIN, N. Y.—Articles of incorporation have been filed for the Berlin Electric Light, Heat & Power Company by James C. Cowie, W. C. Baxter, of Troy, and Victor M. Allen, of Petersburg. The company proposes to operate in Berlin, Petersburg, Grafton and Stephentown.

ROCHESTER, N. Y.—The Rochester, Syracuse & Utica Telephone Company, a reorganization of the Independent Telephone Securities Company, operating in Central New York, has filed a certificate of incorporation with the Secretary of State. The capital stock of the company is placed at $1,500,000 and the directors are: E. W. Beck, G. R. Fuller, W. Roy McCane, of Rochester; E. B. Odell and C. H. Poole, of Utica; H. S. Holden and A. H. Cowle, of Syracuse.

NEW PHILADELPHIA, OHIO.—Articles of incorporation have been filed for the Columbus, Canton & Eastern Transit Company. The company is capitalized at $200,000, and the incorporators are Michael Leibold, W. J. Wise, W. W. Snyder, Clyde J. Krusely, Frank G. Kneugler, F. O. Richards, C. A. W. Reiser and C. S. Rhodes.

CLEVELAND, OHIO.—The Wheeling & Western Traction Company has been incorporated, with a capital stock of $1,000, by A. E. Townsend, T. H. Bierbach, Josiah Wolf, Nathan Fromstine and Herbert Goldpaden.

DILLONVALE, OHIO.—The Mt. Pleasant Electric Light & Power Company has been incorporated with a capital stock of $20,000 by John F. Frasher, Howard T. Roe, O. L. Roe, J. S. Paxton and G. W. Carson.

NEWARK, OHIO.—Articles of incorporation have been filed for the Ohio, Lake Erie & Eastern Railway Company. The capital stock of the company is placed at $2,000,000 and it proposes to construct a railway from Mount Vernon to Wooster. A bond issue of $2,000,000 has been authorized by the directors. The officers of the company are: Frank L. Owen, president; J. F. Shrontz, vice-president; F. E. Elliott, secretary, and J. H. Chilcote, treasurer.

ADA, OKLA.—The Farmers' Independent Teelphone Company has been organized with a capital stock of $6,000, and the following named directors elected: H. M. Parkhurst, J. M. Paney, E. F. Paugh, J. M. Kennedy, F. W. Leferve and T. P. Holt, all of Ada.

DEER CREEK, OKLA.—Articles of incorporation have been filed for the Deer Creek Telephone Company, with a capital stock of $240, by A. R. Squire, W. A. Shipley, C. W. McKowan and others.

KORN, OKLA.—Articles of incorporation have been filed for the Korn Valley Telephone Company. The company is capitalized at $1,200 and the incorporators are: D. D. Weins, of Weatherford; J. J. Warkenton and P. F. Schmidt, of Korn.

MERIDAN, OKLA.—The Springvale Rural Telephone Company has

been incorporated, with a capital stock of $2,000, and the directors are: Lee Smith, S. R. Rushet, W. Jamison, W. Jennings, R. Lowell, John Vincent and A. C. Hamlin, all of Guthrie. The company proposes to erect a telephone system at Evansville, post-office address, Meridan.

Obituary.

MR. LAVELLE MORGAN BLANDING, president of the Binghamton Electrical Construction Company, of Binghamton, N. Y., died at his home on May 2. Mr. Blanding was connected with the Blanding family, of Providence, R. I., and was for years engaged in the drug business. Although he was not very actively engaged in the electrical business, he made a number of friends in the industry who will lament his loss.

MR. JOSEPH REYNOLDS TILLINGHAST, secretary of the Electrical Jobbers' Association and widely known among electrical men, died from apoplexy in Englewood, N. J., on Sunday, May 10. He is survived by a widow. Mr. Tillinghast was born in New York City, Sept. 19, 1844, which made him sixty-four years old at the time of his death. He was the son of Philip Tillinghast, of the well-known manufacturing and commission dry goods firm of Hunt & Tillinghast. Mr. Tillinghast was a graduate of the public schools and attended New York University. After completing his education he traveled abroad for two years, and on his return took charge of his father's woolen mills at Leeds-on-the-Hudson, and later at Bennington, Vt. In 1868 he married Miss Katherine Swift, of Bennington. At one time Mr. Tillinghast was general agent for a prominent insurance company of Providence, R. I., and for several years was associated with the banking firm of Phelps, Dodge & Company. About four years ago he became secretary for the Electrical Jobbers' Association, with offices at 261 Broadway. His son, J. R. Tillinghast, Jr., who died about five years ago, was a graduate of Williams College and a prominent physician of New York City. The following tribute paid to Mr. Tillinghast by one of the great number of his friends gives a fair idea of how he was regarded by his social and business friends: "One of the strongest characteristics of the late Mr. Tillinghast and the one which did the most to make him a popular man among business men, was the absolute and unswerving loyalty which he showed toward his friends. He was the very soul of trustworthiness, an untiring worker and thoroughly unselfish, a high type of man, strong, both in character and ideals. Perhaps the best thing that I can say about him is, that under no conditions, no matter how trying, was he ever anything but a gentleman, in the highest sense of the word." Mr. Tillinghast was the first secretary for the Electrical Club.

Personal.

MR. T. W. MEACHEM, president of The New Process Raw Hide Company, Syracuse, N. Y., has been elected president of the Chamber of Commerce of Syracuse.

MR. WILLIAM PLATTEN has tendered his resignation as superintendent of the light and water plant at Bluffton, Ohio, and has accepted a position as manager and superintendent of the light and water plant at North Attleboro, Mass.

MR. HERBERT C. PETTY was elected, May 13, a director of the Crocker-Wheeler Company. Mr. Petty accepted a position in the sales division of the company January, 1903, and was advanced rapidly to the position of contract manager. His election as director is a recognition of the esteem and confidence which he commands among the stockholders of the company.

MR. THOMAS F. MULLANEY was tendered a complimentary dinner at the Engineers' Club, New York, on May 6, by his friends of the General Electric Company. Mr. Mullaney has just severed his connection of over twenty years to take up work as chief engineer of the Third Avenue Railroad Company, of New York, to which position he was recently appointed. In the early days of the electrical business Mr. Mullaney was connected with the Thomson-Houston Electric Company and later with the General Electric Company. He has always been prominent among construction and operating electrical engineers. Mr. Mullaney has a host of friends throughout the world whose good wishes go with him in his new position.

Unclassified Items.

SAULT STE. MARIE, ONT., CAN.—The power houses of the Tagona Water & Light Company and the Lake Superior Power Company were destroyed by fire May 18, causing a loss of $300,000. The water, lighting and street car systems are affected, but it is expected that electricity for the street railway system will be furnished from the steel plant auxiliary.

SUMMERVILLE, S. C.—An election will soon be held to vote on the proposition to light the streets of the town. The Council is considering the question of entering into a contract with the Crystal Ice & Cold Storage Company to furnish the necessary electrical energy.

CANON CITY, COL.—Plans are being made to organize a company to build an electric power plant and railway which will connect the important towns in the Arkansas Valley from Garden City, Kan., to Canon City, Col. The company will be known as the Kansas-Colorado Power & Railroad Company and will be capitalized at $15,000,000.

PITTSBURG, PA.—The Meyersdale Construction & Equipment Company has been incorporated with a capital stock of $100,000, by H. D. Brenn, W. A. Wood, of Pittsburg and W. W. Stand, of Belleville. The company proposes to construct and operate railways.

ITHACA, N. Y.—The Ithaca Street Railway Company has been granted a franchise to double track its system on certain streets of the city, in return for which the company is to pay the city a rental of $500 per year.

ST. PAUL, MINN.—J. W. Mossop, vice-president of the St. Paul, Minneapolis & Seattle Electric Railway Company has applied to the City Council for a franchise to construct and operate a double track railway from the present terminus of the Rice Street line to Como and Phalen Boulevard.

WILMINGTON, DEL.—The Street and Sewers Directors have granted the Peoples Railway Company a franchise to lay its tracks on Church Street from Seventh to Fourth, and to run its cars near the wharf of the Wilson Line of steamboats.

ST. ANDREWS, FLA.—The St. Andrews Electric Light & Power Company has been formed to furnish electricity for light and power, and to build a 15-ton ice plant. J. H. Drummond is interested in the enterprise.

MITCHELL, S. D.—The plant and holdings of the Mitchell Gas Company, including the electric light plant was purchased by D. A. Mizener for the Mitchell Illuminating & Power Company at a receiver's sale for $25,010. The new company has increased its capital stock to $200,000, and proposes to extend and increase the operation of the plant.

WEATHERFORD, OKLA.—The City Council has authorized plans prepared for an electric light system.

SNYDER, OKLA.—The construction of an electric light plant and water works system are among the improvements contemplated for Snyder.

SACRAMENTO, CAL.—The Board of Supervisors of Sacramento County has granted the Western Power Company a franchise to erect transmission lines through the county. The amount paid for the franchise was $100.

ELGIN, ILL.—The Aurora, Elgin & Chicago Railway Company has appropriated $80,000, for the construction of a substation, which will be located in Elgin, and for which bids for construction are now being received. Edwin C. Faber is general manager, and Edmond A. Bell, chief engineer.

PERRY, N. Y.—The Rochester, Scottsville & Caledonia Railroad Company, which proposes to construct an electric railway from Rochester to Glen Iris Park, has secured a franchise through the town of Perry.

EL CENTRO, CAL.—Extensive improvements are to be made to the power plant located at Holtville, on the Alamo River. An additional turbine and generator will be installed, which will increase the output of the plant by 1000 hp.

WINDBER, PA.—Contracts have been placed by the Berwind-White Coal Company with the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company for the construction and equipment of a central power plant, which will furnish electrical power for operating the various mines of the company in central Pennsylvania. The new station will be located at Windber, and the equipment will include two 1500-hp steam turbine engines and six 500-hp rotary converters, 18 transformers, two 500-hp motors and two motors of 225 hp. The Berwind-White Coal Company is planning to abandon the individual power plants at the different mines and will furnish electrical energy for all of its mines from the new station when completed.

KIRKSVILLE, MO.—The plant and holdings of the Kirksville Electric Company have been purchased by the parties interested in the development of the coal fields just west of the town. It is understood the consideration for the plant was between $45,000 and $50,000. The new company has been organized under the name of the Kirksville Light, Heat & Power Company.

INDIANAPOLIS, IND.—The contract for electric wiring the Coliseum and other buildings at the State Fair Grounds, the driveways and amphitheater, has been awarded by State Agricultural Association to the Standard Electric Machine Company, of this city, for $18,049. The contract for furnishing electricity for lamps during the State Fair has been awarded to the Home Heat & Light Company, at $6,500.

Business Notes.

STANDARD ELECTRICAL WORKS.—In our issue of May 2 mention was made of the fact that the United States Standard Electrical Works Company, of Racine, Wis., had changed its name to the Standard Electrical Works Company. The name of the company should have been Standard Electrical Works instead of that given.

THE AMERICAN BLOWER COMPANY, Detroit, Mich., has purchased the foundry formerly operated by the Northwestern Foundry & Supply Company, of Detroit, which was the manufacturer of cast iron soil pipe and fittings and plumbers' specialties, and will operate the plant in the manufacture of blower, exhaust fan, engine and heater castings.

SCHAEFFER MACHINE WORKS.—Chas F. Schaeffer has withdrawn from the Gray's Ferry Machine Co., and will operate the Schaeffer Machine Works at Thirty-ninth Street and Gray's Ferry Road, Philadelphia. The plant will be designed as a modern machine shop and equipped with the latest type of machine tools.

MR. HERBERT H. HAMMOND, for the past five years secretary and sales manager of the Standard Electric Time Company for all of New England except Connecticut, and all of the territory along the New York Central lines, with an office in Boston, has recently resigned to accept the position of manager of the Electric Time Department of the Dey Time Register Company, Syracuse, N. Y. This company will manufacture complete programme clock systems for schools and factories, and will specialize particularly in synchronizing time registering clocks from a self-winding master regulator. Mr. Hammond is now making his headquarters at the Dey factory in Syracuse.

SPLITDORF IGNITION SPECIALTIES.—C. F. Splitdorf, of New York, the well-known ignition specialist, has opened a well-appointed and commodious store for the sale of his coils, plugs and other ignition specialties at 319 Michigan Avenue, Chicago. Mr. B. P. Houlihan, who for some years has been manager of this firm's San Francisco branch, and who is well and favorably known among the trade, will be in charge of the new store.

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UNITED STATES PATENTS ISSUED MAY 12, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

887,061. CLOSED CIRCUIT THERMOSTAT; George H. Bowen, Boston, Mass. App. filed June 20, 1907. A thermostatic circuit controller designed to be wholly enclosed within a glass tube and having a fusible member forming part of a circuit and heated by contact with the walls of the tube.

887,071. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed Nov. 11, 1903. Complete cord and signal circuits for city exchange system.

887,077. SLEET CUTTER AND SCRAPER; Frank L. Dye, Springfield, Ill. App. filed Jan. 28, 1908. In addition to the usual trolley wheel, the patentee has a supplemental wheel mounted on a supplemental pole section which has a toothed thread so as to cut away the ice in advance of the usual wheel.

887,087. ELECTRIC THERMOSTAT; Harry G. Geissinger, New York, N. Y. App. filed May 29, 1907. An apparatus for regulating and controlling temperature. Has a thermal couple comprising a rigid channel-shaped element having closed ends, and a flexible element having its extremities abutting against said closed ends and supported in the rigid element by such contact.

887,088. SYSTEM OF TEMPERATURE CONTROL; Harry G. Geissinger, New York, N. Y. App. filed July 3, 1907. A system of control which permits the regulation of temperature in each room or apartment to be made independently of that in the other rooms. Each room has a separate thermostat acting on the electro-magnetically operated air valves of the heating system.

887,096. ELECTRIC INTERRUPTER AND INTERMITTER; John Robert Kelley, Cincinnati, Ohio. App. filed Aug. 8, 1907. Interrupter for use with induction coils and the like for interrupting a primary current into a very great number of separate impulses. Has an anode consisting of a tube or hollow cylinder of platino-iridium, and a gold core within said cylinder.

887,106. ARMATURE WINDING MACHINE; Charles H. Lewis, New Haven, Conn. App. filed June 15, 1905. Relates to machines for winding wire on armatures, by which a plurality of armatures may be wound simultaneously, and in which the wire is guided and the tension regulated automatically. Has a series of armature holders with a common axis of rotation and adapted to grip a plurality of armatures so that they will rotate on the same axis.

887,107. WIRE FASTENER FOR INSULATORS; Fred M. Locke, Victor, N. Y. App. filed Nov. 24, 1905. The insulator has an open groove on its upper surface with slightly undercut edges. The wire is held in the groove by a pair of conical plugs which are engaged endwise over the wire and fastened together.

887,123. ELECTRODE FOR ELECTRIC FURNACES AND PROCESS OF MAKING THE SAME; Edgar F. Price and Frank J. Tone, Niagara Falls, N. Y. App. filed Jan. 8, 1906. An electrode for furnaces comprising a mixture of electrically produced graphite, amorphous carbon and a binder.

887,124. VOICE-SCREEN FOR TRANSMITTER-MOUTHPIECES; Robert H. Ralston, Denver, Col. App. filed Sept. 1, 1906. A funnel adapted to be applied to an ordinary transmitter to direct speech thereinto.

887,127. ELECTRIC ARC LAMP; Victor Watson Riley and Herbert William Rowing, London, England. App. filed March 10, 1906. A feeding mechanism for electric arc lamps of the type in which the upper carbon is fed by gravity and separated from the lower carbon by a solenoid-operated clutch. Relates to details of construction.

887,157. ELECTRIC ALARM THERMOMETER; Wilhelm Walther, Homburg, Germany. App. filed March 12, 1907. An alarm thermometer having a mercury tube with a pair of platinum contacts which serve to complete one or more electric arcs in each of which an electric alarm device is provided. Has a wire gauze shield which surrounds the mercury tube, so that the alarm will occur before the tube breaks.

887,166. ELECTRIC PUSH BUTTON; Henry Wilhelm, New York, N. Y. App. filed Aug. 1, 1907. Construction of push button having a sheet metal casing which is assembled upon a porcelain block carrying the contact springs.

887,169. SIGNAL OR SWITCH APPARATUS AND SIGNALING SYSTEM; Adoniram J. Wilson, Westfield, N. J. App. filed Oct. 15, 1902. Provides a signal apparatus in which the signal is adapted to assume at least three positions. Makes use of fluid pressure motors for operating the signal. Has liquid gas motors, the liquid gas being stored in a tank in proximity to the signal.

887,220. APPARATUS FOR PRODUCING VOLTAIC HIGH CURRENT ARCS; Harry Pauling, Gelsenkirchen, Germany. App. filed Sept. 30, 1907. An apparatus for the production of voltaic high current arcs in which the arcs are produced by means of diverging electrodes and by a current of gas which blows the discharges along the electrodes so as to form arcs of the required lengths which break and extinguish after attaining a definite length.

887,221. LIGHTNING ARRESTER; John Pearson, Somerset, Wis. App. filed Nov. 24, 1905. Provides an improved lightning arrester which will allow a free discharge from a line to the ground of abnormally high static charges such as produced by lightning, but which will offer great resistance to the dynamo or line current and not permit such flow thereof to the ground as would short circuit the generator and thereby impair the good running condition of the system.

887,222. MEANS FOR AUTOMATICALLY CONTROLLING VOLTAGE AND POWER FACTOR OF GENERATORS OPERATING IN MULTIPLE; John Pearson, Somerset, Wis. App. filed March 1, 1906. Provides means for automatically controlling the fields of generators located in distant stations, whereby the same will be operated in multiple when delivering electric energy over the same transmission line.

887,231. TELEPHONE-TRANSMITTER; Elmer R. Corwin, Clyde, Ill. App. filed Dec. 27, 1906. Details of microphone contact and diaphragm.

887,233. CALL-REGISTER FOR TELEPHONE SYSTEMS; William W. Dean, Elyria, Ohio. App. filed Oct. 18, 1906. The combination with a transmitter, of signaling and registering devices, and means for supporting said signaling and registering devices from the front plate of such transmitter inside of the chamber formed by the back of such transmitter.

887,253. VALVE OPERATING MECHANISM; William B. Jackson, Madison, Wis. App. filed Oct. 6, 1905. A valve operating mechanism for controlling the opening and closure of large valves controlling water flow through pipes or pen-stocks.

887,260. OPERATOR'S SELECTIVE RINGING-KEY FOR TELEPHONE SYSTEMS; Ray H. Manson, Elyria, Ohio. App. filed Nov. 15, 1904. Mechanical features of keys including detent rollers by which they are held depressed.

887,261. ELECTRICAL SIGNALING AND SWITCHING APPARATUS; Ray H. Manson, Elyria, Ohio. App. filed June 14, 1905. A combined self-restoring drop and jack. Relates to mechanical features of construction of the drop shutter.

887,263. CONNECTION SWITCH; George K. Thompson, Newton Highlands, Mass., and Frank R. McBerty, Evanston, Ill. App. filed Dec. 7, 1904. A telephone plug is enclosed in a conical housing which fits over and encloses the jack so as to afford adequate protection against injury from accidental high potential currents on the line.

887,266. PROCESS FOR CONCENTRATING NITRIC ACID; Harry Pauling, Gelsenkirchen, Germany. App. filed Aug. 13, 1906. A process consisting in electrolyzing aqueous nitric acid and passing the nitric oxides, formed at the cathode, into the acid surrounding the anode.

887,287. RAILWAY SWITCHING APPARATUS; John D. Taylor, Pittsburg, Pa. App. filed Jan. 11, 1904. Railway switching apparatus in which a number of switches are operated and controlled from a central station, the controlling levers interlocking with one another to prevent conflicting routes. Includes complete electrical and mechanical features. Has means for governing the passage of cars or vehicles along a railway.

887,288. APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY AND THE CONTROL THEREOF; John D. Taylor, Edgewood Park, Pa. App. filed Oct. 26, 1904. Relates to modifications of the above.

887,289. APPARATUS FOR CONTROLLING THE PASSAGE OF TRAINS; John D. Taylor, Wilkinsburg, Pa. App. filed Oct. 26, 1904. Covers additional modifications.

887,290. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; John D. Taylor, Pittsburg, Pa. App. filed Aug. 23, 1906. Covers still further modifications.

887,291. SAFETY CONTROLLER FOR ELECTRIC SWITCH OPERATING APPARATUS; John D. Taylor, Pittsburg, Pa. App. filed Dec. 8, 1906. Relates to electric switches and a means by which they are selectively displaced to one position or the other by successive closures of an operating or pilot circuit.

887,326. OXIDATION OF NITROGEN BY MEANS OF ELECTRICITY; Demetrio Helbig, Rome, Italy. App. filed Jan. 23, 1905. The art of oxidizing atmospheric nitrogen which consists in passing the gas to be treated through a chamber having surfaces of its walls of ionizing material, striking an electric arc within the chamber and ionizing the gas therein, and increasing the length of the arc until the flame passing across the arc fills the chamber and intercepts the stream of gas passing through the same.

887,331. ELECTRIC WATER HEATER; Oscar Johnson, of Seattle, Wash. App. filed Dec. 29, 1905. A water heater making use of a cylindrical casing with a number of nesting cylindrical partitions between the water flows and which constitute resistance elements.

887,333. ELECTRICAL HEATING ELEMENT; Frank Kuhn, Detroit, Mich. App. filed Oct. 15, 1907. Construction of sad-iron having a central chamber in which a resistance element is received. The resistance element is held in place by a spring which establishes the electrical connections.

887,336. ELECTRIC INSULATOR; Herman Mieth, Vallejo, Cal. App. filed May 29, 1906. A construction of insulator for high-potential transmission lines and wireless installations. Has a rod with a main cylindrical casing, and an auxiliary cylindrical casing extending upwardly into the main casing over said rod and the interposed insulation.

887,357. WIRELESS TELEPHONE; Nathan B. Stubblefield, Murray, Ky. App. filed April 5, 1907. A telephone system for use on canals and rivers and depending on magnetic induction. The boat or conveyance has a flat coil in proximity to the telephone line extending along the path of travel.

887,358. WALL BRACKET; George F. Swortfiger, Newark, N. J. App. filed May 1, 1905. A cast-iron bracket having a plurality of prongs adapted to receive insulators in an offset relation to one another, whereby the line connections may be easily made.

887,439. TROLLEY WHEEL FOR ELECTRIC CARS; George C. Stratton, Camden, N. J. App. filed July 18, 1907. The wheel is journaled between a pair of concentrically revoluble plates having radially projecting spokes or arms designed to close over the trolley wire.

887,442. CONTROLLER; Lewis L. Tatum, Norwood, Ohio. App. filed June 28, 1906. The controller drum has a pair of cams thereon each engaged by the spring-impelled detent rollers and which co-operate together to prevent improper movements of the controller drum.

887,473. TELEPHONE-RECEIVER; William Gibson, Danbury, Conn. App. filed Aug. 23, 1907. A telephone-receiver formed in two parts from vitreous material, combined with a screw threaded metal ring on one part, and a screw threaded metal collar interlocked with the other part.

887,476. APPARATUS FOR ELECTRIC OXIDIZING OF ATMOSPHERIC NITROGEN; Demetrio Helbig, Rome, Italy. App. filed Jan. 5, 1906. The combination with a chamber having a wall surface of ionizing material and a gas entrance and a gas exhaust, of electrodes at opposite sides of said chamber and located adjacent to the walls thereof for producing an electric arc across the same.

887,482. ELECTROCOSMETIC FACE MASK; Gustave C. Lammers, Oakland, Cal., and Sanford Bennett, Alameda, Cal. App. filed Aug. 26, 1907. A device for the treatment of the face, comprising a rigid mask folded to fit an individual face and formed of material capable of conducting an electrical current to the surface of the skin.

887,483. ELECTRICALLY PROPELLED VEHICLE; Joseph Ledwinka, Philadelphia, Pa. App. filed Aug. 3, 1907. A driving unit comprising two vehicle supporting wheels which are maintained in axial alignment, but are relatively rotatable by independently controllable motors. Is particularly applicable to trucks for trolley railway cars.

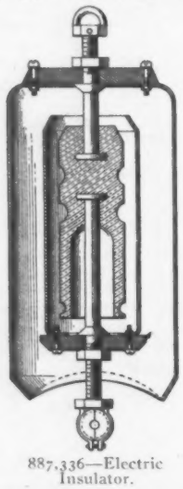
887,496. OUTLET BOX COVER; George B. McBean, Chicago, Ill. App. filed Jan. 4, 1907. A cover for outlet boxes adapted for attachment to a box and having an integral tubular socket and radial ribs connecting the rearwardly extending portion of the socket to the inner face of the cover, said ribs being integral with the socket and the cover. Has suitable terminals carried by the socket at its inner end.

887,501. ELECTRICAL CUT-OUT; Philip Thomas McNally, Mandan, N. D. App. filed June 28, 1907. A cut-out device by which a small circuit wire from the power house is extended to the cut-out device at a remote point, to operate an electromagnet and give the initial impulse for bringing into service another magnet which throws the switch.

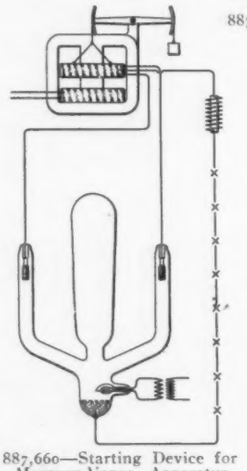
887,504. AUTOMATIC SWITCH FOR TROLLEY LINES; Joseph Nelson, Cape May, N. J. App. filed Aug. 30, 1907. The trolley pole has a pair of special contact rollers adapted to engage plates alongside the trolley wire and selectively energize magnets controlling the switch point.

887,514. OPERATING MECHANISM FOR RADIATOR VALVES, ETC.; William H. Pearce, Chicago, Ill. App. filed June 28, 1906. Operating mechanism for radiator valves. Makes use of a special spiral wire the free extremity of which moves between contacts to constitute a thermostat and which selectively energizes electromagnets controlling the valves of the radiator or similar device.

887,520. INSULATOR; John Wm. Rehling, Allegheny, Pa. App. filed Sept. 6, 1907. A generally rectangular porcelain block having a pair of projecting lugs with roughened surfaces between which the conductor is received in a zig-zag path.



887,336—Electric Insulator.



887,660—Starting Device for Mercury-Vapor Apparatus.

887,521. DYNAMO ELECTRIC MACHINE; Henry G. Reist, Schenectady, N. Y. App. filed Jan. 24, 1902. A rotatable element for a generator designed to withstand very high centrifugal stresses. The rim of the rotatable element is made of steel plates which are interlocked together with great strength and rigidity.

887,525. LIGHTNING ARRESTER; David B. Rushmore, Schenectady, N. Y. App. filed Jan. 5, 1907. Has a plurality of spark gaps arranged in groups and connecting the line conductor to the ground. Some of the groups are shunted by graduated resistances.

887,527. SERIES MULTIPLE SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed May 22, 1905. A means whereby two or more incandescent lamps can be connected either with all the lamps extinguished or with all in series to give a dim light, or with one lamp only to give a brighter light, or else the full illumination. Is made in the form of an ordinary turn-button snap switch.

887,533. APPARATUS FOR TELEPHONING; Frederik Sindingchristensen, New York, N. Y. App. filed May 17, 1901. A telephone apparatus comprising line-conductors, condensers arranged at intervals therealong and joined in parallel thereby, a grounded induction coil joined to one end of one of said line-conductors, a transmitter circuit for affecting said induction coil, and a grounded receiver connected to the remote end of the other line-conductor.

887,539. MOVABLE PLATING APPARATUS; George P. Stevens, Chicago, Ill. App. filed Aug. 27, 1907. Has a tank and a support for the work elevated above the intended level for the solution in the tank, and means for reciprocating such support.

887,559. REVOLVING MULTIPLE FUSE BLOCK; Enoch Westerdahl, Thief River Falls, Minn. App. filed May 27, 1907. Makes use of a cylindrical drum notched to receive a plurality of fuses about its periphery and rotatable to position the fuses successively in a circuit.

887,576. RAILWAY SIGNAL; Sofrony Bayas, Los Angeles, Cal. App. filed April 15, 1907. The patentee provides a pair of special trolley wires which are adapted to be energized by a generator within the locomotive cab and actuate alarm signals in case another train should be on the same block or section.

887,598. ELECTRICAL CONDENSER SUITABLE FOR USE IN WIRELESS TELEGRAPHY AND OTHER PURPOSES; Lucien Henri Delloye, Paris, France. App. filed March 26, 1906. An electrical condenser comprising a pair of wire nettings imbedded in a block of glass.

887,612. CONTROLLING MEANS FOR ALTERNATING-CURRENT MOTORS; Augustine R. Everest, Lynn, Mass. App. filed June 22, 1905. In combination with an alternating-current motor adapted to be operated from a single-phase source of supply having different connection for starting and for running, a normally open switch included in the starting connections, a magnet winding in series with said motor, and means controlled by said magnet winding for closing said switch to establish starting connections.

887,639. DYNAMO ELECTRIC MACHINE; Louis R. Horning, Norwood, Ohio. App. filed Feb. 28, 1906. Has a plurality of brushes and brush studs, and straight insulated links joining adjacent brush studs for the purpose of bracing some to prevent vibration.

887,642. VAPOR ELECTRIC APPARATUS; Alexander McLeod Jackson, Schenectady, N. Y. App. filed Dec. 9, 1903. Mercury vapor apparatus comprising main electrodes and an auxiliary electrode, and a current-limiting resistance in circuit with the auxiliary electrode and located in heat-transferring relation to said auxiliary electrode.

887,645. ANTISEPTIC LINING OF TALKING AND HEARING TUBES FOR TELEPHONES; Hermann Jankelowitz, Gera, Germany. App. filed May 25, 1907. Antiseptic lining for telephone transmitters and receivers consisting of a plurality of superposed sheets of antiseptic paper rolled up from a long strip with lateral projections registering with each other.

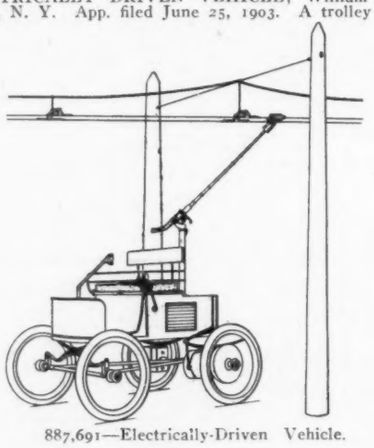
887,659. RECTIFIER SYSTEM; Osias O. Kruh, Schenectady, N. Y. App. filed Sept. 17, 1907. A mercury arc rectifier having main electrodes and starting electrodes, and inductive means for preventing the shifting of the cathode spot from one of the main electrodes to one of the starting electrodes.

887,660. STARTING DEVICE FOR MERCURY VAPOR APPARATUS; Osias O. Kruth, Schenectady, N. Y. App. filed Oct. 14, 1907. Has a hermetically sealed tube with electrodes and a starting conductor having a surface of barium oxid and a protecting shield.

887,666. ELECTRIC WATER PURIFIER; James F. Lester, New York, N. Y. App. filed Nov. 28, 1906. Has a series of filter drums through which the water is passed, and a drum containing concentrically arranged circular plates which are electrified to pass an electric current through the fluid.

887,681. ELECTRIC SIGNALING; Francis W. Maxstadt and Francis W. Maxstadt, Jr., New York, N. Y. App. filed May 10, 1907. A construction of bell having a sheet metal base which is bent to form a support for the bell at one end and a support for the armature at the other.

887,691. ELECTRICALLY DRIVEN VEHICLE; William B. Potter, Schenectady, N. Y. App. filed June 25, 1903. A trolley for use on electric automobiles and the like, having a pair of trolley wheels connected by a universal joint to the trolley pole and maintained by springs in contact with a pair of trolley wires, regardless of the position of the pole.



887,691—Electrically-Driven Vehicle.

887,723. ELECTRICAL SWITCH; John D. Hilliard, Jr., and Charles E. Parsons, of Utica, N. Y. App. filed May 13, 1905. Oil bath switch having a pair of contact elements supported within depending bell-shaped insulators, and a movable contact displaced by a rod extending upwardly from the bottom of the receptacle.

887,735. PROCESS OF RECOVERING NICKEL FROM SILICIOUS ORES; Adolphe Chalas, Philadelphia, Pa. App. filed Sept. 6, 1907. Consists in smelting the ore and producing ferro-nickel, casting the alloy into anodes, electrolytically dissolving the anodes, continuously precipitating the dissolved iron by circulating the electrolyte in contact with a body of a precipitating agent, and redepositing the dissolved nickel.

887,737. MAGNETIC BLOW-OUT FOR MAKE AND BREAK DEVICES; Stephen Dudley Field, Stockbridge, Mass. App. filed Dec. 12, 1907. A means for instantaneously extinguishing the spark that occurs at the make and break contact point when the primary circuit of an induction coil is broken. The spark is caused to take place in a magnetic field.

12,793 (reissue). APPARATUS FOR THE REGULATION OF ELECTRIC SYSTEMS; George A. Wells, Jr., New York, N. Y. App. filed June 22, 1906. A means for relieving electrical systems from the widely varying stresses caused by the changing demands of a fluctuating load. Has means for temporarily storing the energy in a fly-wheel from which it is subsequently absorbed by the system.

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ADVERTISE IN THE ELECTRICAL WORLD.